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THE STORY OF CREATION.

A PLAIN ACCOUNT OF EVOLUTION.

BY EDWARD CLODD.

PART II.

CHAPTER V.—THE ORIGIN OF SPECIES—*continued.*

VI. *Natural selection tends to maintain the balance between living things and their surroundings. These surroundings change; therefore living things must adapt themselves thereto, or perish.*

IN treating of the obscurity which hangs around the ultimate causes of variation of living things, stress has been laid on the ceaseless and elusively complex interplay between them and the medium which surrounds, quickens, and nourishes them. As Gegenbaur remarks, the energies which cause changes in the organism either lie without the organism or for the most part are to be sought for without it.* An important distinction has to be made at the outset between plants and animals in the feebler response of the plant to its surroundings through the early secretion of cellulose which walls it in, and in its greater subjection to those surroundings by virtue of its fixed place. While the animal can wander, within certain limits, in search of food, the plant is compelled to take what comes to it, and, moreover, is powerless to escape the effects of altered temperature and climate. Hence its range of variation is limited compared to that of the animal. And however numerous the species of plants may be, the differences between them do not lie in the modes of nutrition, but in the modes of reproduction, whereas in animals, in addition to the variation in their modes of locomotion, we find them divided into three groups: 1, simple forms without body cavity; 2, higher forms with body cavity; 3, highest forms with digestive cavity separate from body cavity. But for this early "parting of the ways" life would probably have remained vegetal.

That the *touch* of the medium was the first quickener of variation is shown in the rise of the earliest approach to unlikeness at the surface, as in the membranous film which envelopes the lowest life-forms, and, among the higher animals, in the gradual specialisation of lines of communication—the nervous system and sense organs—with the outer world from infoldings of the skin. The diffused sensitiveness to smell, light, and sound became localised, the sense of touch remaining general over the body-surface, except where horny skin is secreted. Obviously, therefore, the tendency to vary which inheres in living things being stimulated by interaction between them and their surroundings, the degree in which variations are useful to living things—*i.e.*, in enabling them to win in the universal struggle for food and place—determines, under the action of natural selection, their survival.

The slow but ceaseless changes in things without have involved adaptive changes in all organisms except the lowest. Seemingly, all things remain as they were from the beginning. The range of our experience is too narrow, the time since scientific observation of nature began is comparatively so recent, the changes in living things so beyond direct detection, that we cannot wonder at people's reluctance to accept the theory that the countless species of plants and animals which have succeeded one another have a common descent, through infinite modification, from structureless germs. And, in fact, not only is life vastly older than any record of it, but the fossil-yielding rocks supply no key to the origin of the leading groups, whose representative types of to-day are so little altered that every fossil as yet found can be put into existing classes. Huxley remarks that "the whole lapse of geological time has thus far yielded not a single new ordinal type of vegetable structure," and although "the positive change in passing from the recent to the ancient animal world is greater, it is still singularly small."* The variation in ordinal type of animal structure is only about ten per cent. of the whole.

Yet we know that nothing is rigid; the earth records the gradual ascent of life-forms in structure and the changes in its crust, in a scripture that cannot be broken. The agencies within, and the far more potent agencies without, that have wrought those changes, pursue without pause their slow and sometimes sudden working. The great globe itself, on which a mere fraction of the sun's energy suffices to sustain life, speeds through space; careens and brings the seasons in their sureness; spins and gives, unfailing, the glory of sunrises and sunsets; and, in periodic changes of its orbit, crowns at one epoch its poles with vines and oaks and water-lilies, and at another epoch covers them with impassable snow.

Changes of climate and level, with the alterations in soil which they bring about, profoundly affect food and the power to obtain it. And the necessity for food being a strong—perhaps the strongest—stimulus to motion, the organism which the more readily adapts itself to the changed conditions, or is better equipped to resist them, wins in the struggle. The new functions to be discharged involve changes in structure, because the organs exist for the work which they have to do, not the work for the organs. Moreover, changes which arise in the structure are not limited to one part, the whole organisation being, in Darwin's words, "so tied together during its growth and development that when slight variations in any one part occur, and are accumulated through natural selection, other parts become modified." Take, for example, the growth of the deer's antlers, which in some species attain a weight of seventy pounds in a few weeks. The increased supply of blood which this involves necessitates readjustment of circulation, and the increased weight which the skull has to bear necessitates more powerful muscles and ligaments, with increased strength of the bones to which they are attached. More food is needed to supply the energy thus expended, involving more active digestion, and therefore modification of the digestive organs.

So far as the individual is concerned, there are the changes wrought in it by use and disuse—in the one case leading to the development of organs, in the other case to their decline. "Thus I find," Darwin remarks, "in the domestic duck that the bones of the wing weigh less and the bones of the leg

* "Comparative Anatomy," p. 57 (Eng. ed.).

* "Lay Sermons," p. 216.

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more in proportion to the whole skeleton than do the same bones in the wild duck, and this change may be safely attributed to the domestic duck flying much less and walking much more than its wild parents.* But changes which are induced in organs by their use or disuse on the part of the animal are not transmitted; they die with the individual in which they occur. They are powerless to affect the type. It is to natural selection that we must refer modifications which, appearing as relics of structure common to large groups, have a specious look of being due to individual use or disuse. Take, for example, the whale as an illustration of this. The epitome of its ancestry which the embryo presents reveals its descent from land mammals having short fore and hind limbs, scanty covering of hair, broad beaver-like tails, teeth of different shape, and well-developed sense organs, especially of smell. These forefathers of the whale probably lived in marshy districts, and, being omnivorous, sought their food in both swamp and shallow water. As conditions more and more adverse to life on land supervened, they were gradually modified under the action of natural selection into dolphin-like creatures, living in fresh water, and at last, finding their way into the ocean, from which the huge sea-lizards of earlier epochs had disappeared, leaving these leviathans scope "to play therein." Hence are explained the adaptive changes of structure: the fore-limbs were modified into flippers enclosed in a fin-like sac, but retaining the bones corresponding to like structures in other mammals, as in the arm of man, the wing of the bat, and the fore-leg of the horse; whilst of the hind legs traces may be detected in a few species; the tail, which acted as a powerful swimming organ, became divided into two lobes; the head became fish-like in shape; the seven bones of the neck common to most mammals grew together; the skin became hairless; and the teeth, which appear in the young whale but are never cut, gave place to hanging fringes of whalebone, in the meshes of which the animal entangles the minute organisms upon which it feeds. In the seal, which is the modified descendant of land flesh-feeders, the hind legs have been developed, while the tail remains rudimentary.

Of course the existing species of whales and seals are the slowly modified descendants of only a small percentage of ancestors, who, in virtue of their favourable adaptations to altered conditions of life, survived under the operation of natural selection, by which also the majority, being unfit or less adapted, were weeded out.

Natural selection, therefore, is not causal, but directive. It is powerless to bring about the slightest variation in plant or animal; it is all-powerful to preserve variations "beneficial to the being under its conditions of life . . . it can do nothing until favourable individual differences or variations occur, and until a place in the natural polity of the country can be better filled by some modification of some one or more of its inhabitants."† Moreover, since it tends to establish balance between life and its surroundings, it does not imply all round development of the higher from the lower. Its key-note is adaptation. To quote Herbert Spencer's remarks on the erroneous conception of Evolution as implying that everything has an *intrinsic* tendency to become something higher: "if in the case of the living aggregates forming a species the environing actions remain constant from generation to generation, the species remains constant. If those actions change, the species changes until it is in adjustment with them. But it by no means follows that this change in the species constitutes a step in evolution. Usually neither advance nor recession results; and often, certain previously-acquired structures being rendered superfluous, there results a simpler form. Only now and then does the environing change initiate in the organism a new complication, and so produce a somewhat higher type."*

The sea-squirts and, perhaps, the marvellous rotifers, are examples of recession; actual degradation is probably limited to parasites; while in the unaltered condition of the simplest forms since the appearance of their earliest known representatives, we have examples of persistence of type. Their simplicity has been their salvation. A high organisation brings with it many disadvantages, for the more complex the structure the more liable is it to get out of gear. Unfortunately we cannot have highly convoluted brains, and digestive organs simple and renewable as those of the sea-cucumber, so that to the highest life-forms evolution is not all gain.

Variety of readjustment to altered conditions, resulting in progress in some directions and in stagnation in other directions, is evidenced in existing modifications of the common mammalian type. We find one group—plant-feeders—developing organs suited to their functions, as teeth for grinding and large stomachs, and also acquiring organs of defence or escape. In the flesh-feeders we find economy of bulk, great muscular strength, and, as compared with plant-feeders, prominent development of organs of attack. In both groups we find progression of parts which in the group including man are well nigh stationary. Among the Primates limbs, teeth, and organs of digestion, have all been slightly modified, and no organs of defence and attack developed. The explanation is that the animals, being unable to compete with the larger mammals, took to an arboreal life, which induced few variations of bodily structure, the most important being an opposable thumb and great toe for grasping. But the need for alertness against foes sharpened their wits, and the need of combination quickened the social instincts, so that the energy which in the flesh-feeders and the plant-feeders was stored in limb and muscle, was diverted in the Primates to development of brain. They thus escaped the limitations of one condition, which determined the development of lions and rhinoceroses in a given direction, and they preserved the power to adapt themselves to very diverse conditions. As shown by his career since the earliest times that we have record of him, this was markedly the case with the apelike ancestors of man. For his difference from existing apes is not in bodily form; the impassable chasm between him and them lies in the superior intelligence which he possesses in virtue of his more complex thinking apparatus. The arrangement of the furrows of his brain is much the same as theirs, but the convolutions are deeper the higher we ascend the scale, the gap between the civilised man and the savage being greater than that between the savage and the man-like apes.

Of the propositions expounded in the present and foregoing chapters this is the sum:—No two living things are exactly alike. Their inherent tendency to vary is excited by their surroundings, on which all life depends, and to changes in which they must adapt themselves or perish. Every living thing transmits its qualities, and therefore its variations, to its offspring; the more useful the variation the better is the plant or animal equipped in the struggle for life. For as all living things tend to multiply so rapidly that the earth would be too small in a very short time for a single species, a fierce and ceaseless struggle is waged, chiefly between the same species, for food and place. The result is that by far the larger number never reach maturity,

* "Origin of Species," p. 8.
† "Origin of Species," pp. 63 and 137.

* "Principles of Sociology," p. 107.

or are killed and eaten. In the long result variations give rise to new species.

The only assumption at the base of Darwin's theory is that sufficient time has elapsed since the beginning of life for the development of all past and present species of plants and animals from a common ancestry. As to the age of the earth, more especially as a fit and possible abode of life, geologists and physicists are not agreed. The geological estimate rests chiefly upon the rates at which the deposit of sediment, or the wearing away of soil by rain and rivers, are going on; but that estimate is based upon the assumption that present changes are the measure of past changes, whereas uniform action does not exclude the possibility of great and sudden revolutions. But, on the whole, the argument from geological evidence is strongly in favour of the lapse of not much less than one hundred million years since the earliest life-forms appeared and the oldest stratified rocks began to be laid down. This is much longer than the physicists, reasoning from the origin and age of the sun's heat, the rate of the earth's cooling, and other data, are willing to allow. But, however the question may be finally settled, the result cannot affect the evidence in support of the theory of descent which is supplied by the facts—1, of Embryology, or likeness of beginnings; 2, of Morphology, or likeness of structure; 3, of Classification of plants and animals; and 4, of their Distribution both in space and time.

WILD YOUTH'S TAX ON LIFE.*

By HENRY WARD BEECHER.

OLD age has the foundation of its joy or its sorrow laid in youth. Every stone laid in the foundation takes hold of every stone in the wall up to the very eaves of the building; and every deed, right or wrong, that transpires in youth reaches forward, and has a relation to all the afterpart of man's life. A man's life is not like the contiguous cells in a bee's honeycomb: it is more like the separate parts of a plant which unfolds out of itself, every part bearing relation to all that antecede. That which one does in youth is the root, and all the afterparts, middle age and old age, are the branches and the fruits, whose character the root will determine.

Every man belongs to an economy in which he has a right to calculate, or his friends for him, on eighty years as a fair term of life. His body is placed in a world adapted to nourish and protect it. Nature is congenial. There are elements enough of mischief in it if a man pleases to find them out. A man can wear his body out as quickly as he pleases, destroy it if he will, but, after all, the great laws of nature are nourishing laws, and, comprehensively regarded, nature is the universal nurse, the universal physician of our race, guarding us against evil, warning us of it by incipient pains, setting up signals of danger, not outwardly, but inwardly, and cautioning us by sorrows and by pains for our benefit. Every immoderate draft which is made by the appetites and passions is so much sent forward to be cashed in old age. We may sin at one end, but God takes it off at the other. Every man has stored up for him some eighty years, if he knows how to keep them, and those eighty years, like a bank of deposit, are full of treasures; but youth, through ignorance or through immoderate passions, is wont continually to draw cheques on old age. Men do not suppose that they are doing it, although told that the wicked shall not live out half their days.

Men are accustomed to look upon the excesses of youth as something that belongs to that time. They say that of course the young, like colts unbridled, will disport themselves. There is no harm in colts disporting themselves, but a colt never gets drunk. I do not object to any amount of gaiety or vivacity that lies within the bounds of reason or of health; but I do reject and abhor, as worthy to be stigmatised as dishonourable and unmanly, every such course in youth as takes away strength, vigour, and purity from old age. I do not believe that any man should take the candle of his old age and light it by the vices of his youth. Every man that transcends nature's laws in youth is taking beforehand those treasures that are stored up for his old age; he is taking the food that should have been his sustenance in old age, and exhausting it in riotous living in his youth. Mere gaiety and exhilaration are wholesome: they violate no law, moral or physical.

I do not object to mirth or gaiety, but I do object to any man's making an animal of himself by living for the gratification of his own animal passions. People frequently think that to require in the conduct of youth that which we expect in later life has something of Puritanism in it. Men have an impression that youth is very much like wine—crude and insipid until it has fermented, but when it has fermented, and thrown down the lees, and the scum has been drawn off, the great body between is sound and wholesome and beautiful. I am not one that thinks so. I think that youth is the beginning of the plant life, and that every wart or excrescence is so much enfeeblement of its fruit-bearing power. I do not believe that any man is the better for having learned the whole career of drunkenness or of lust, or the dallyings or indulgences that belong to a morbid life. A young man who has gone through these things may be saved at last, but in after life he has not the sensibility nor the purity nor the moral stamina that he ought to have. He has gone through an experience but for which his manhood would have been stronger and nobler. I thoroughly disbelieve that a man is any better for having in his youth passed through an experience that developed his animal nature and his lustful appetites. Excess in youth, in regard to animal indulgence, is bankruptcy in old age.

For this reason I deprecate late hours, irregular hours, or irregular sleep. People ask me frequently, "Do you think there is any harm in dancing?" No, I do not. There is much good in it. "Do you, then, object to dancing parties?" No; in themselves I do not. But where unknit youth, unripe muscle, unsettled and unhardened nerves are put through an excess of excitement, treated with stimulants, fed irregularly and with unwholesome food, surrounded with gaiety which is excessive and which is protracted through hours when they should be asleep, I object, not because of the dancing, but because of the dissipation. It is taking the time that unquestionably was intended for sleep, and spending it in the highest state of exhilaration and excitement. The harm is not in the dancing itself; for if they danced as do the peasants, in the open air, upon the grass under the trees, and in the day, it might be commended, not as virtuous, but still belonging to those negative things that may be beautiful. But the wassail in the night, the wastefulness—I will not say of precarious hours, for hours are not half so precarious as nerves are—the dissipation, continued night after night and week after week through the whole season, it is this I deprecate as eating out the very life. I am not superstitious of observances, but I am always thankful that there are forty days of Lent in the year when folks can rest from their debauches and dissipations; when no round of excessive excitement in the

* This article was written by Beecher only a fortnight before his death. It was probably his last contribution to periodical literature.

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pursuit of pleasure is permitted to come in and ruin the health and cripple the natural powers of the young.

The appetites of youth, which either in social or in solitary life drain down the vitality and impair the constitution, are so many insidious assaults on old age. I would that the young knew how clearly these things are written. God's handwriting is very plain and very legible to those who have eyes to see. There is not an intelligent physician that does not read, as he walks through the street, the secret history of the lives of those whom he meets, and that, too, without following them in their midnight career. I care not to have men come to me and state their secret courses; I can read it in the skin and in the eye. There is not one single appetite of passion that has not its natural language, and every undue indulgence of that appetite or passion leaves that natural language more or less stamped upon the skin, upon the features, upon the expression of the face, or the carriage of the body. There is always some token that tells what men are doing, if they are doing anything to excess. Pride has its natural language; mirthfulness has; goodness has. Nobody doubts this. So have the passions their natural language. Men think that if they commit their wickedness in secret places, or in the night, that it is not known. It is known, although no man may ever say to them: "Thou art guilty!"

The use of stimulants in youth is another detraction from happiness in old age. Men usually take what they least need. In other words, we follow our strongest faculties, and not our weaker ones; and therefore if men are excessively nervous they almost invariably seek to make themselves more so.

I rejoice to say that I was brought up from my youth to abstain from tobacco. It is unhealthy; it is filthy from beginning to end. In rare cases, where there is already some unhealthy or morbid tendency in the system, it is possible that it may be used with some benefit; but ordinarily it is unhealthy. I believe that the day will come when a young man will be proud of not being addicted to the use of stimulants of any kind. I believe the day will come when not to drink, not to use tobacco, not to waste one's strength in the secret indulgence of passion, but to be true to one's nature, true to God's law, to be sound, robust, cheerful, and to be conscious that these elements of strength and health are derived from the reverent obedience of the commandments of God, will be a matter of ambition and endeavour among men.

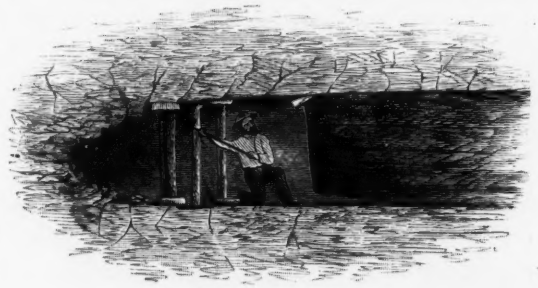
COAL.

By W. Mattieu Williams.

"LONG-WALL" working is more economical than the methods already described, as it leaves behind no supporting pillars of coal. To understand it, let us suppose that roads are driven in the coal from the pit to the boundary of the "royalty" or area to be worked, and that these lead to another road which crosses them and follows the boundary. In this case the coal has to be removed from the boundary towards the pit. Further, suppose that the roads from the pit are one hundred yards apart, and it is obvious that between each of these roads there is a face or wall of coal one hundred yards long. The problem is to cut away this wall on the side towards the pit, and carry all the coal into the pit roads without crushing the men as the unsupported roof comes down.

The illustration shows how this is done. It represents the face of the coal as seen in section from the end of one of these pit roads looking forward into the road that is parallel to the boundary. The man is kneeling in face of the wall of the coal to be removed, and working towards the pit. He has already undercut the seam, and is breaking it down, "holeing" it, by striking the wedge. Behind him are seen three props for supporting the roof at the part from which the coal has been removed, and behind these pillars is the *goaf* or *gob*, *i.e.*, the ruins of the crushed-in strata which always give way to the superincumbent pressure when any considerable area is left unsupported. When the cutter has brought down a few feet more of the face upon which he is now working, and the coal has been carried away, the hindmost row of props is knocked away, and brought forward to form a front row, the roof which they formerly supported now falling down.

It is commonly imagined that great cavities are left in the sites of worked-out coal-mines, and geological and even cosmical theories have been based on the assumption that



the shrinkage of the cooling earth will leave vast cavities beneath its crust, in which the ocean will finally be engulfed and leave the surface of the earth as arid as that of the moon. An examination of the goafs and creeps of coal workings would, I think, completely convert the most earnest advocates of these views. I have groped through many celebrated natural caverns, and find them to be nothing more than narrow tunnels with occasional enlargements, the widest of which cannot display an unsupported roof nearly equal in length and span to the Midland Railway Station at King's Cross.

Although such caverns are continuously in the course of formation and enlargement wherever surface water percolates limestone rocks, they usually crush in even before attaining the dimensions of the Albert Hall. The crushing in of the roof of the ten-yard seam in South Staffordshire is a continual source of minor artificial earthquakes.

Houses are split down the middle, and others toppled over; railways drop, and have to be continually relevelled. In the report of the Committee on Accidents in Coal Mines, 1849, we are told that "it is a matter of everyday occurrence for houses to fall down, or a row of buildings inhabited by numerous families to assume a very irregular outline, from what they call a *swag* caused by the sinking of the ground into old workings. It is often a serious matter to find a sound site for church or school building. . . . There is an instance in the parish of Sedgley of a church and parsonage house, recently erected, composed of wooden framework, which will admit of their being screwed up into the perpendicular again whenever they may be thrown out of it." Similar troubles on a serious scale are now occurring over the Cheshire salt mines. The newspapers of a week or two since report that in one of the main thoroughfares of Northwich "the foundation of a shop, together with about ten yards of the adjoining footpath, sank into a deep

pit, which soon became filled with water," and that "a pit four yards in diameter and five yards deep was suddenly formed in the Hartford volunteer drill shed."

In some cases this crushing down of the superincumbent rock supersedes the work of wedging; the coal comes down when merely undercut. This of course increases the demand for props, and renders the working more dangerous. A great deal has been written about the limits of depth to which it is possible to carry coal working. Hull estimates it at about 4,000 feet, and this is pretty generally accepted on account of the high temperature that would be there reached. For reasons that I will discuss hereafter I believe that the temperature difficulty may be overcome, and that the limit of depth at which it is possible to mine for coal or any other mineral will be determined by the viscosity of the crust of the earth, by its flowing after the manner of liquids when subjected to a sufficient amount of pressure. I venture to predict that if ever the "trou Flammarion"—the great boring into the earth's interior—is carried out as projected, a limiting depth will be reached by the inflowing of the granitic rock.

Gunpowder blasting is used in some collieries instead of the wedge, but only where there is no firedamp. Even in the absence of such combustible gas, blasting may be dangerous. Mr. Galloway has proved, by an exhaustive course of observations and experiments, that in collieries where the workings are dry serious explosions may result from the firing of mere coal dust. A substitute for blasting has been proposed which appears promising, but I am not able to estimate its practical merits. This is to bore a hole as in blasting (which is very easily done in a soft material like coal), ram quicklime into this, and then allow water to percolate therein. Quicklime combines chemically with water, forming the hydrate of lime, and in doing so expands with great force.

Long-wall working may be carried out by commencing near the shaft and working away from it towards the boundary. In this case gob-roads have to be made in the goaf or fallen *débris*, and such roads must be supported artificially. Under this system a profitable return is obtained much sooner than when the working is begun at the boundary. All the time in cutting the roads is saved, and the first getting of coal is so near to the pit that the *putting*, or carriage underground, is reduced to a minimum at the commencement. If any of my readers are tempted to take shares in a successfully working colliery, and the temptation is backed by the display of a balance-sheet showing large profits, let him inquire into the mode of working, as he may be perfectly assured that, if this method of beginning near the pit is in operation, the cost of working will gradually increase with the increasing length of gob-roads that require expensive supporting, and the gradually increasing distance along which the coal must be dragged before reaching the pit. On the other hand, if the method of working I first described is in operation, that from the boundary pit-wards, these expenses will go on diminishing with every stage of progress towards the pit; besides which there must be roads ready made which represent a considerable amount of capital value.

It would be out of place here to go into further details concerning modifications of long work, or intermediate methods partaking of the character of long work and pillar-and-stall work combined. I may add that when I was in North Wales about twenty years ago the introduction of long-wall work met with considerable opposition among the Flintshire colliers. They supposed it to be more dangerous than the older methods. It probably was so at first, but now that it is better understood the majority of practical mining engineers and of underground stewards maintain that it is less dangerous, and this conclusion is confirmed by the statistics of colliery fatalities.

Among the good old books of reference demanding a new edition carried forward to date is the "Cyclopædia of Useful Arts," by Charles Tomlinson. In the article "Coal" therein are painful pictures representing some bygone horrors of colliery work. There is (page 396) "a hurrier in a Halifax coal pit," a girl in her teens harnessed like a beast, by means of girdle and chain called a *dog-belt*, to a lorry or coal truck, and dragging it like a beast on all fours through the dark, dripping tunnels of the pit. She is barefooted, bare-legged, and naked downwards to the hips. Another picture of "coal-bearing in the East Scotland mines" represents two girls carrying the coal in baskets on their backs up a ladder of villanous construction. Other pictures of women carrying coal on their backs along steep underground roads, and up a "turnpike stair" or screw platform, are too truthful representations of barbaric practices which are now totally abolished in Britain, though still lingering on in other countries. Our legislation has justly prohibited the employment of girls and women in any capacity whatever underground, and the ruin which the blind worshippers of demand and supply predicted as a consequence of this interference has not befallen us, but on the contrary, it has enforced upon capitalists the adoption of other methods which have proved themselves, not only more humane, but actually more economical and profitable.

In the course of our current jubilations, many historical summaries of our progress during the last fifty years have been published; but I find little or nothing there stated concerning the general emancipation of women from degrading unfeminine occupations and excessive hours of toil. A special chapter might well be devoted to this feature of our social progress, as one especially worthy of attention, and proudly characteristic of the reign of Queen Victoria.

All pit roads are now railroads. Where the inclines are steep and straight, and in many cases where they are not steep, steam-power is used to haul the "tubs" or pit wagons to the shaft. The power is applied to a winding drum, which hauls a long rope to which a train of tubs is attached. Where the incline exceeds 1 in 30 the empty tubs are run down by gravitation, dragging out the rope from the drum as they descend. If the incline is insufficient, a tail rope is attached, and the empty tubs and hauling rope are drawn down by this.

In colliery working, as in everything else, conservative resistance to progress exists, and on this account, as well as from local difficulties, horse and even boy power is still used in drawing the tubs along the roads. Welsh and Shetland ponies are consequently in demand for pit work. I see by to-day's newspaper (April 9) that at Lord Londonderry's sale Shetland ponies "brought from sixteen to thirty guineas apiece." The writer adds that "many of the hapless little animals sold on Thursday are doubtless destined to pass the rest of their lives at the bottom of a black and hollow vault," and he refers to the alleged brutality of rough pitmen in the treatment of these animals, but is willing to believe that considerable improvement has recently taken place.

I quote this in order to correct the popular errors which it expresses. Colliers as a class are by no means rough and brutal, less so than average London wagon and cart drivers, and the condition of pit ponies is one that London cab or omnibus horses may justly envy. They are well fed, not overworked, commonly petted, and demonstrate the good treatment they receive by their condition. It is well known in colliery districts that ponies generally improve in condition and value by underground work. Given two ordinary

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Welsh ponies of equal age and equal market value, take one down a coal pit to work in the ordinary manner for six months, and let the other work above ground for the same period. At the end of the time the pit pony will sell for 20 per cent. more than the other in any horse fair. The fine condition of the coat of pit horses is proverbial. It is partly due, no doubt, to the climate, which is always temperate, with a variation of only a few degrees. Such a climate is especially favourable to horses.

ANCIENT SOLAR FESTIVALS.*

By W. St. Chad Boscawen.

AMONG a star-gazing people like the ancient Chaldeans, the equinoxes became early observed, and of this testimony is furnished by inscriptions recording the dates of the equinoxes. These inscriptions come from the royal college library of Nineveh, and form part of the great collection of astronomical and astrological documents found there. In these documents, of which I quote the following example, the natural phenomena of the equinox are observed (W. A. I., iii. 51. 1) :—"The sixth day of the month Nisan, the day and the night balanced. There were six *kaspu* of day, six *kaspu* of night." This report shows how from the temple observatories of Assyria in the reign of Assurbanipal (B.C. 664), the equality of day and night has been noted, each consisting of six periods or *kaspu*, each of two hours' duration. These periods of diurnal measurement were each again subdivided into three periods or watches of two hours each, and each astronomical occurrence was carefully noted as to the period in which it occurred. But the fact that the periods of the equinoxes and the solstices were made the time of great religious festivals was first made clear by the discovery of a calendar of the Babylonian year, which is now supplemented by the valuable tablet recording the solar festivals discovered by Mr. Rassam amid the ruins of the ancient city of Sippara of the Sun, the Chaldean Heliopolis. This tablet, dated on the twentieth day of the month Nisan, in the thirty-first year of Nabubaliddina, king of Babylon, records the four great solar festivals of that year which were honoured by donations from the great king. The first point to be ascertained is the date of this document before the Christian era, and this we can approximately arrive at from his reign being synchronous with those of two of the important monarchs of the middle Assyrian empire. He appears first in the records of Assyria in B.C. 879, and he concluded a treaty of peace with Shalmaneser II., which lasted until B.C. 853, when his son succeeded him as ruler. Upon these facts we may place the date of this important record as from B.C. 853 to B.C. 860. The dates of the equinoxial festivals given in this record are as follows :—

On the seventh day of Nisan. This was the feast of the new year, and corresponded to the Jewish Passover. Corresponding to this feast of the vernal equinox there was in Tisri or Tasrituv, the seventh month, on the seventh day, the feast of the autumnal equinox. We know from the astronomical tablets that the four points on the great circle marked by the equinoxial and solsticial periods were called the positions of the *nibiru*, or "crossings," or "passings over." In the Creation tablets these points are said to have been specially fixed by the god Bel or Belus, whom both the inscriptions and Berosus agree in making the ruler of the astronomical bodies, times, and seasons. The above tablet now reveals to us the very important fact of the existence and observation of a second pair of older equinoxial festivals. On the tenth day of Airu or Iyar, the second month, and on the fourteenth day of Marchesvan, the eighth month, are a second pair of corresponding festivals, which from their positions on the great circle are evidently old equinoxial festivals, which by the precession of the equinoxes had given place to a new pair of festivals.

In the time of Hipparchus, and as far back as B.C. 2540, the vernal equinox had fallen in the constellation Aries, and in the astronomical inscriptions copied from the library of Sargon of Aganne, a monarch who reigned prior to the Median or Cassile dynasty in the nineteenth century B.C., the vernal equinox was in Nisan and in Aries. But it is evident from this inscription that there was a time in the annals of Babylonian astronomy when the vernal and autumnal equinoxes fell in Taurus and Scorpio. The foundation of Babylonian astronomy dates back to the period of poliarchy, the period prior to the rise of the Median dynasty; and although we cannot accept the prodigious antiquity which Berosus and other Greek writers assign to it, the remote period of its existence is clearly evident. The compilation of the great astronomical work, consisting of seventy tablets or books, entitled "Namar Beli, the Illumination of Bel," an edition of which has been found in the royal library at Nineveh, was a work carried out by order of Sargon I., King of Aganne, a monarch whose rule was prior to the Median conquest. As regards this work there is much internal evidence that it was prepared by the Kusho-Semitic people, not by the Tartar Akkadians. With the former the nightly observation of the stars during their nomadic wanderings had led to the development of a certain amount of natural science regarding the celestial phenomena. In the pages of the great Babylonian astronomical work there are afforded many interesting glimpses of the popular life and thoughts. The stars are entitled "the sheep," and an important star, which I am inclined to regard as the pole star of the period, bore the name of the star "Sib-zi-an-na," "the shepherd of the heavenly flock"; while the morning and evening stars* bore such poetic titles as Lulim, "the leaders," or, as an inscription shows the word in pastoral phraseology to mean, "the bell wether," or "leader of the flock." In the omens deduced from celestial appearances we find such as affect the life of the nomad, "Rain in heaven, floods in the channels," reminding us of the favourite Arab expression, "The stars have brought rain," "Cattle are safe in the pastures," "The enemy sweeps all away." Such phrases as these, written three or four thousand years ago, have still a close agreement with modern Bedouin Arab life. The Akkadian element which appears in the astronomy and astrology of the Babylonians is most apparent in the abstruse mathematical calculations and theories of star-influences on the life, which result from the Fetish or Animist creed of the Tartar Akkadians, and in which, when the tablets have been thoroughly examined, I expect that we shall find the basis of the Cabbalistic

* This interesting essay was sent us several years ago, and marked for early insertion, but was mislaid in a volume of star maps which had been used in examining some of its astronomical statements. It curiously confirms many of the ideas to which I have been led in drawing up my essays on "The Unknowable." I have recently obtained other evidence about the stars as interpreted in ancient times which will be found, I think, to render Mr. Boscawen's subject especially interesting.—Ed.

* I should be disposed to doubt this interpretation—that is, if the words "morning and evening stars" signify, as usual, Venus. Might not the stars heliacally rising and setting be understood?

theories of the Jews. At the time when the great astronomical work of the Chaldeans was compiled, and when the calendar was fixed, which we must, as far as evidence goes, place about B.C. 2000–2500, the bright star Thuban in the constellation Draco was near to the pole. Placed as this star Thuban, *a* Draconis, is, it seems to me to be very possibly the star called "the star of the tip of the tail."* This star was especially the omen of weather changes. We read, "The star of the tip of the tail a great cloud obscures. Locusts in the land are," or "The star of the tip of the tail at its rising, the waves of the sea rise at the beginning of the month Tammuz." The connection of this constellation and its bright star with storms, tempest, and sea, certainly seem to connect it with the storm-dragon, the demon who figures so often in Chaldean mythology, and may, as you have so truly pointed out, be a relic of astro-mythology. The occurrence of these equinoxial festivals on the newly-discovered inscription from Sippara serves to show that we must place the rise and, to a certain extent, scientific development of Babylonian astronomy further back in the past than we have hitherto expected. The very remarkable find of a complete library of tablets in the priests' quarters of one of the oldest Babylonian temples, which has resulted from recent explorations, may no doubt throw further and more clear light upon some of the obscure points in the astronomy of the ancient Chaldeans. Should any such be found, I shall be glad to place them before the readers of KNOWLEDGE, who will no doubt estimate their scientific value better than I am able to do.

SOLUTIONS OF PUZZLES.

I. BUILDING A TRIANGULAR PYRAMID.

PROBLEM XXV. (see last Number). To arrange equal regular tetrahedrons and octahedrons, with equal triangular faces, into a single tetrahedron (or regular triangular pyramid) set six of the tetrahedrons on the base ABC, as shown in fig. 1, where *a*, *b*, *c*, *d*, *e*, *f*, represent the apices of six tetrahedrons standing on the bases ADF, DFG, FGK, EBH, GHL, and KLC.

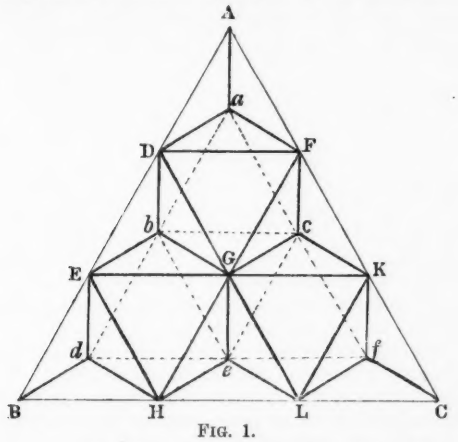


FIG. 1.

It is then seen that three octahedrons will fit into the spaces DaFcGb, EbGeHd, and GcKfLe, their upper triangular faces (regarding ABC as the *base* of the pyramid we are building up) being, respectively, *abc*, *bde*, and *cef*. Now insert a seventh tetrahedron into the space *bce*, with an angle downwards at G. We have then the triangular surface *adf*. We now set a tetrahedron on each of the triangles *abc*, *bde*, and *cef*; fit in a tetrahedron between them; on whose triangular upper face we set a tetrahedron, and the regular tetrahedron or triangular pyramid with equilateral faces on the equilateral base ABC is complete.

[The outlines of the tetrahedrons and octahedrons above the lowest layer are not shown, but the reader will have no difficulty in seeing how the upper layers forming a pyramid on the base *adf* are formed. He may regard the part AEK of the figure as showing this, for it shows three tetrahedrons, ADF, DEG, FGK, one octahedron DaFcGb, and the base *abc* of the tetrahedron needed to complete the regular tetrahedron on the base AEK.]

SCHOL.—The numbers of octahedrons and tetrahedrons required to complete the successive layers of a built-up tetrahedron are as follows, going downwards:—

Layer.	No. of Tetrahedrons.		No. of Octahedrons.
1	1		0
2	[1+2]	or 3	1
3	[1+1+2+3]	or 7	[1+2] or 3
4	[1+2+1+2+3+4]	or 13	[1+2+3] or 6
&c.	. . . . .		. . . . .
n	$\left[\frac{(n-2)(n-1)}{2}+\frac{n(n+1)}{2}\right]$ or n^2-n+1		$\frac{(n-1)n}{2}$

Hence the total numbers of tetrahedrons and octahedrons required to form a tetrahedron, each of whose edges is n times as long as an edge of the smaller solids, are as follows:—

Tetrahedrons

$$=\Sigma_n^1(n^2-n+1)=\frac{n}{6}(n+1)(2n+1)-\frac{n(n-1)}{2}=\frac{n}{3}(n^2+2)$$

Octahedrons

$$=\Sigma_n^1\left(\frac{n^2-n}{2}\right)=\frac{n}{12}(n+1)(2n+1)-\frac{n(n+1)}{4}=\frac{n}{6}(n^2-1)$$

Thus the ratio of the number of tetrahedrons to the number of octahedrons is

$$2n^2+4 : n^2-1;$$

and when n is very great this ratio becomes very nearly equal to 2 : 1.

We can now very readily see in what ways sliding is possible when space has been filled up with tetrahedrons and square-based pyramids, or with tetrahedrons and octahedrons, in the manner considered above, and in Puzzles XXII., XXIII., and XXIV., solved last month.

First, note that in the less interesting case first dealt with last month, where tetrahedrons and half octahedrons are used, we get layers which may be shifted as layers in directions parallel to their plane faces. Once shifted so that the triangular faces of pyramids and tetrahedrons no longer coincide, there is no shifting of strips; but when these faces are brought into coincidence, as in the building up of the four based pyramid, we see that longitudinal strips, formed of rows of pyramids with tetrahedrons fitted in between them, can be shifted in the direction of their length. There are four other ways of sliding layers with corresponding ways of sliding strips which will be recognised from the study of what follows.

Secondly, when space is built up of tetrahedrons and octahedrons, in the manner indicated above in the solution of Problem XXIII., as well as in that of the problem we have just dealt with (both methods giving precisely the same arrangement so far as the filling in of space is concerned), we have the following ways of sliding layers. In

* This, from what follows, seems impossible. For the "star of the tip of the tail" is described as "rising." The pole star does not rise.—ED.

the method of building up, illustrated in fig. 1, we have a series of layers parallel to the triangular face ABC. But also manifestly we have a series parallel to those faces of the built-up pyramid which have AB, BC, and AC respectively as base. Hence there are four directions in which parallel layers can be slid. And clearly when the faces of tetrahedrons and octahedrons agree (after sliding layers in any of these four ways), we can slide strips such as the three AFHB *aced*, ADLC *abef*, BEKC *dbcf*, in the directions of their length; while corresponding strips can be carried in other three directions for each of the three plane positions corresponding to the three other faces of the tetrahedron, having AB, BC, and CA, respectively, as base.

Thirdly, when space is built up of the solid, considered in the solution of Problem XXIV., no sliding or shifting is possible, without breach of continuity.

II.—PROBLEM OF THE HONEYCOMB CELL-ENDS.

[Why Puzzle XXVI. is thus called will be seen further on.]

PUZZLE XXVI. The reader will have noticed a slight error in the statement of this puzzle. The arrangement in the second box of oranges as described in the February number is not symmetrical like that of the oranges in a triangular pyramid. It differs in that the centres of any row of oranges are vertically over those of the row next but one above and below, whereas in the triangular pyramid of oranges the centre of an orange is vertically over the space between three oranges in the layer next but one below, as well as in the layer next below. It is this last arrangement we have to deal with, in which the oranges are set as in the first and third arrangement, so far as regards the set of oranges touching any given orange.

The only difficulty with this puzzle is in making the solution clear without occupying too much space or giving more time to the matter than it may seem to be worth, though the study of it affords excellent geometrical gymnastic.

Figs. 2 and 3 show two ways of viewing a globe symmetrically surrounded by twelve equal globes touching it and each other. The globes in the two figures are lettered

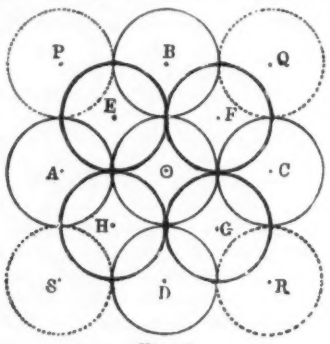


FIG. 2.

alike. In fig. 2 the four heavy circles are supposed to represent eight globes, four in the uppermost layer, four below these. The layer between contains five globes in the form of a cross, the middle one being the surrounded globe we are chiefly considering. The four dotted circles represent globes necessary in building up the group, but not among those which touch the middle globe. In fig. 3 the three dotted globes are the lowest layer, the lightly marked ones the middle layer, and the heavy ones the top layer. Small italic letters mark the centres of globes belonging to lower layers.

In fig. 4 the circle ABCD, and in fig. 5 the circle A*e*F*f*CGH, are supposed to be orthogonal views of the surrounded globe, with the points where the several globes surrounding it touch its surface. Outline dots show points of contact seen through the globe. At E, F, G, and H (fig. 4) two points

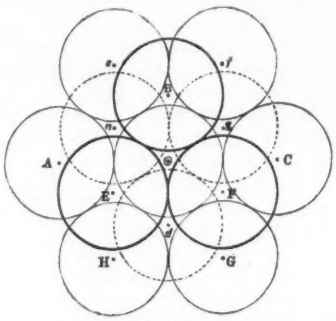


FIG. 3.

coincide; this is shown by circles outside dots. Fig. 2 accounts for the arrangement of the dots marking contact points in fig. 4, while fig. 3 accounts for that of the corresponding points in fig. 5. The reader who cannot after a little thought demonstrate this, and understand details, would not care to follow a verbal demonstration. But indeed the figures will explain and demonstrate by themselves the relations dealt with, for all readers of geometrical proclivities—and no others are likely to read these lines.

Now it is clear that, when the globes all simultaneously expand, the pressing surfaces will become plane, and those inclosing the expanded globe ABCD, figs. 4 and 5, will touch

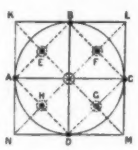


FIG. 4.

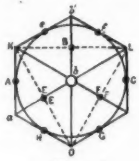


FIG. 5.

the sphere ABCD at the points of original contact with neighbouring globes.

This premised, we see that the planes touching the sphere ABCD at E, F, G, H (both above and below the plane ABCD) meet at a point in O, vertically above the centre of the sphere as seen, and have the apparent forms OAKB, OBLC, OCMD, and ODNA—which are squares—but being really rhombuses having shorter diameters AB, BC, CD, and DA in real length, and longer diameters OK, OL, OM, and ON in apparent length. These longer diameters are obviously slanted 45° to the line of sight (consider fig. 2, to see that this must be so), hence their real length will be AK$\sqrt{2}$. Calling the common radius of the original globes r, the longer and shorter diagonals of these rhombuses or diamonds will be respectively $\sqrt{2}r$ and $2r$. We perceive, further, that the plane-faces touching ABCD at A, B, C, and D, are foreshortened into the straight lines NK, KL, LM, and NM, which, regarded as straight lines, are diagonals of other rhombuses, and are each equal to $2r$.

Our solid figure has then eight rhombus faces, all equal, viz., the four supposed to be seen in fig. 4, and the four on the farther side, which, if visible, would have the same outlines in the orthogonal or perspective representation. The figure has four other rhombus faces whose shape has still to be determined. But we know already that each of these four other faces has a diameter equal to the longer diameter of the eight faces already determined.

Fig. 5 enables us to determine the other diameter. We see that the planes touching the sphere ABCD, fig. 5, in the

points B, E, F, meet at a point in b vertically above the centre of the sphere, and have the apparent forms $oaKb$, $Kb'Lb$, $Lcob$, while those on the farther side, if seen through the sphere, would have the forms $aKb'b$, $bb'Lc$, and $abco$. Now obviously all these are equal rhombuses; so that as two of those on the upper side are rhombuses of a size and shape already determined, so also is the third $KbLb'$. But this can easily be independently demonstrated. For the diameter KL is obviously equal to AC or $2r$, while bb', which appears to be equal to $\frac{2r}{\sqrt{3}}$, is really seen at an angle equal to that between the perpendicular from an angle of a regular tetrahedron on an opposite face and an edge through that angle (consider fig. 3 to see that this must be so). Therefore bb' is really equal to $\frac{2r}{\sqrt{3}}$, increased in the proportion which an edge of a regular tetrahedron bears to such a perpendicular, or as 2 to $\sqrt{\frac{8}{3}}$. Hence the shorter diagonal of the rhombus $bKb'L$ is really equal to $\frac{2r}{\sqrt{3}} \cdot 2\sqrt{\frac{3}{8}} = \sqrt{2}.r$, as before.

In fact, the semiregular solid formed by the expansion of the elastic surfaces of the equal globes is no other than the solid considered in the solution of Problem XXIV., in our last number.

The rhombuses shown in perspective in fig. 5 are identical in shape with those seen at the ends of the cells of the honeycomb, when these cells are regular.

III. THE ALPENSTOCK PUZZLE.

PUZZLE XXVII. I must deal briefly with this, having already given more space than I intended to the solutions of these problems. (I would remark, however, that the study of all these problems will be found to afford excellent exercise in tridimensional geometry.)

The "ingenious beast" having explained his ideas *en route* to his two masculine fellow-travellers, they proceeded at once on their arrival at their resting-place to the following construction:—

Laying down the six sticks AB, DE, &c., in the position shown in fig. 6, LM, NO, and PQ lying upon the others, and

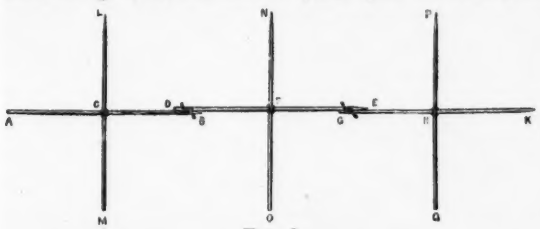


FIG. 6.

all crossing at their middle points, they tied them with stout cord at DB and GE, and at C, F, H. Then two of them brought K over to A, tying the sticks AB and GK together by the ends AK, while the third brought the ends L, N, M together and stoutly tied them. Thus they had the sticks in the form shown in fig. 7. Then they used the ropes which as careful mountaineers they used in travelling to "seat" the triangular spaces ACH, BCF, EFH. As an end of one of these ropes had already been used in fastening the ends N, P, L together, it was easy to carry the rest of this rope down under C, F, and H outside the slant alpenstocks, giving the lines CH, HF, and CF, which admit of being tautened to any necessary extent, by carrying the rope in the directions shown by the dotted lines within the triangle CHF. This makes the ropes within the seat-triangles taut and strong, while shawls or wraps thrown over these seats make them sufficiently comfortable for an *al fresco* meal. Anyone sitting alone at AK, DB, or EG, can tip the whole concern

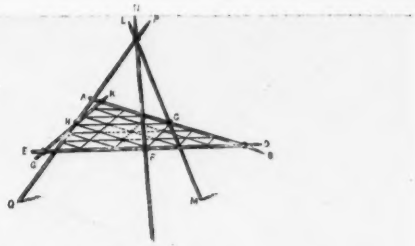


FIG. 7.

over; but the seats are not meant to be used in that way. But two people sitting even so absurdly as this—that is to say, one at AK, the other at EG—would not disturb the equilibrium of the seat. When two sit on each side of C, two on each side of F, and two on each side of H, all six are safe, assuming the alpenstocks sufficiently (and the six people not too) stout.

OUR PUZZLES
OR
MATHEMATICAL RECREATIONS FOR MAY.

PROBLEM XXVIII. *A mathematically disposed person is troubled by the circumstance that he sees himself in an ordinary mirror, not as his friends see him, but with his right side where they see his left, and* vice-versâ. *Also, it seems to him a nuisance that he has always to go in front of his mirror to see himself in it at all. He therefore divides his mirror into two parts, and so fits these that wherever he may be in his room (his eyes not being, however, above or below certain convenient limits of level), he can see himself in the mirror as newly adjusted, and always as his friends see him, not as one usually sees oneself in a mirror. How did he manage this?*

PROBLEM XXIX. *Supposing the eight corners of a room lined with mirror glass, agreeing exactly with the plane surfaces of the walls, ceiling, and floor (the room having all its faces perfectly rectangular), what would one see on looking into any corner?*

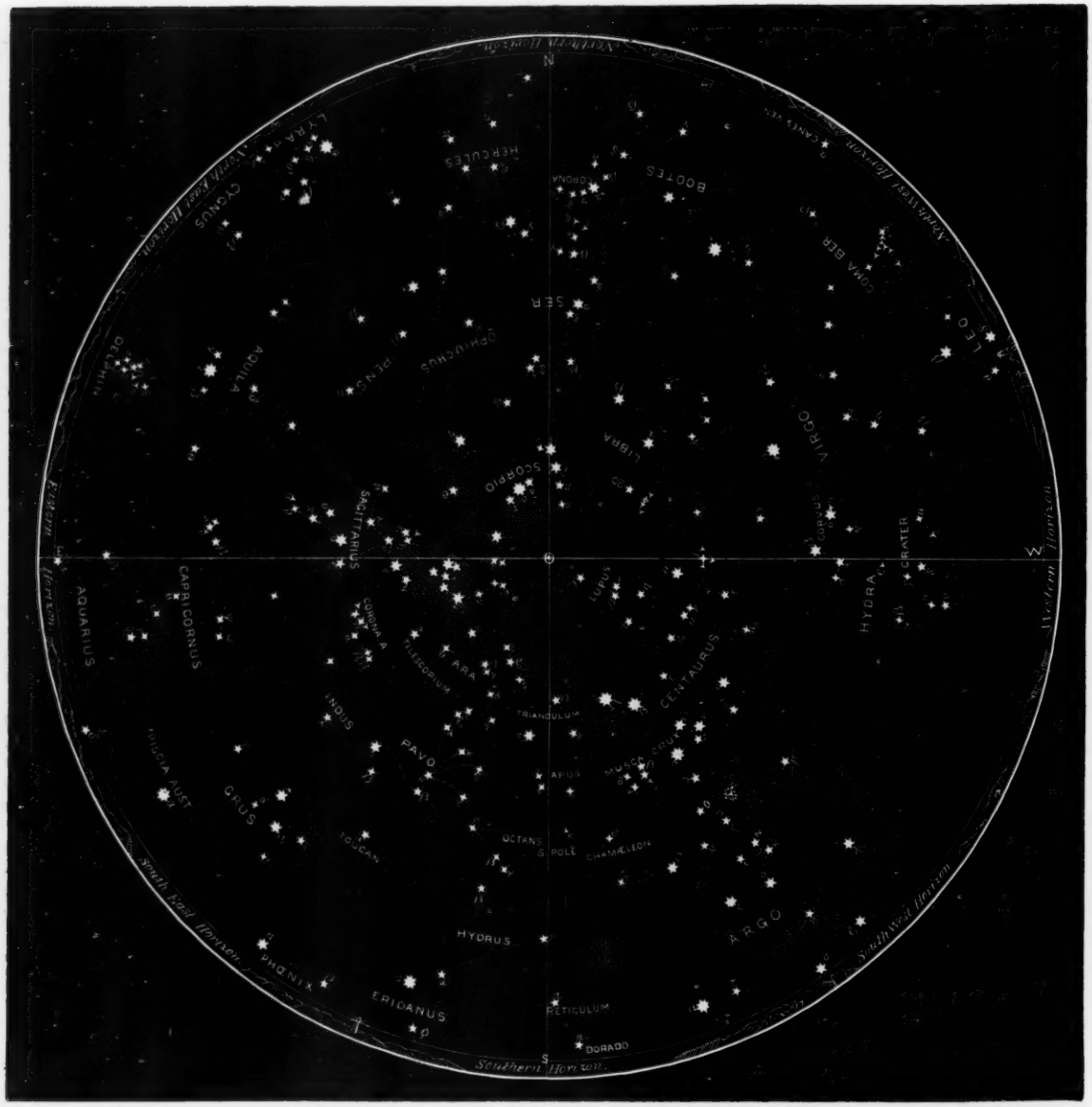
PROBLEM XXX. *Supposing the twelve edges of the same room lined with mirror glass, how many images of himself could any one within the room see, and in what positions and aspects?*

CURIOUS OBSERVATIONS ON THE GROWTH OF THE HEART.—Dr. Benecke, of Marburg, has made known his curious observations on the growth of the human heart, the fact appearing that the increase is greatest and most rapid during the first and second years of life, its bulk at the end of the second year being exactly double what it originally was; between the second and seventh years it is again almost doubled. A slower rate of growth now sets in, until about the fifteenth year, the augmentation of volume during the intervening seven or eight years being only about two-thirds. In the period of maturity which now approaches the growth of the heart again makes progress, the increase keeping pace with the advance toward maturity of the other portions of the system. After the fifteenth year, up to the fiftieth, the annual growth is about ·061 of a cubic inch, the increase ceasing with the fiftieth year, a slight diminution then ensuing. Again, in childhood the male and female heart are alike; after maturity, the male heart develops more than the female, and the difference between the two that is thus established—one and a half to two cubic inches—is said to be maintained throughout the remainder of life.

XUM

THE SOUTHERN SKIES.

MAP VII.—For April, May, and June.



THE NIGHT SKIES IN THE SOUTHERN HEMISPHERE (LAT. 46° TO 24° S.)
AND THE
SOUTHERN SKIES IN ENGLAND (UPPER HALF OF MAP ONLY) AT THE FOLLOWING TIMES:

At 1 o'clock, morning, May 7.	At 11 o'clock, night, June 7.	At 9 o'clock, night, July 7.
„ 12.30 „ „ May 15.	„ 10.30 „ „ June 14.	„ 8.30 „ „ July 14.
„ Midnight, May 22.	„ 10 „ „ June 22.	„ 8 „ „ July 26.
„ 11.30 o'clock, night, May 30.	„ 9.30 „ „ June 30.	„ 7.30 „ „ Aug. 3.

STAR MAGNITUDES.

First . . . . ✲ Second . . . . ✶ Third . . . . ★ Fourth . . . . ✦ Fifth . . . . ▲

MAP IV.
by Richd A. Proctor.
The linear scale radially is uniform throughout; the thwart scale is greater by 1/35th half way to the edge, and by 1/10th at the edge.
MAP 1
MAP 2
MAP 3
MAP 4
MAP 5
MAP 6
HUDSON B.
DOMINION
UNITED STATES
ATLANTIC OCEAN
G. OF MEXICO
CARIBBEAN SEA
PACIFIC OCEAN
TROPIC OF CANCER
EQUATOR
Scale of Miles at centre of map, and radially all over map
English Miles
Small areas are greater by 1/35th half way to the edge, and by 1/10th at the edge.

THE ONE-SCALE ATLAS.

WE give another map of this series, reserving an account of the method in which the sphere has been divided, and each map projected, till our space is less crowded.

THE LETTER "H" IN ENGLAND.

A LETTER recently appeared in the *New York Tribune* of September 27 on the use and misuse of the letter "h" in England, in which some very absurd mistakes were made. This is a subject of much greater difficulty and complexity than many imagine. During my lecture-travels in England I have made many inquiries into the diversities of usage in regard to the letter "h" in different parts of the old country, and into the changes which have been noticed by provincial families during the last forty or fifty years. The results have been rather curious and somewhat difficult to interpret. They tend, however, to show that the habit of dropping the "h" has spread from the large towns—as if it was a habit resulting from that slurring of speech which is apt to occur where men are always busily at work. In dull and quiet places, "far from the madding crowd," resistance against the slurring of the "h" has continued longer. In fact it was not until the rapid extension of railway communication, in the years 1835 to 1845, that the provinces were overspread by the careless way of using the "h," which had long prevailed in the metropolis and around busy centres.

The use of an aspirate where no aspirate should be is a fault which, though now nearly as widespread as the dropping of the "h," is of later origin. It arose apparently from the felt necessity for some strengthening of the language (enervated by lost aspirates) when emphasis was required. It is commonly supposed, especially in America, that among the ill-cultured in England the "h" is habitually dropped where it should be used, and thrown in where it has no business. But this is a mistake. When in an American newspaper "han Henglishman his made to hex-haspirate 'is haitches" after that fashion, every Englishman recognises the incorrectness of the caricature. In the well-known comment by a veterinary surgeon, in one of Leech's pictures, "It ayn't the 'unting as 'urts 'im, it's the 'ammer, 'ammer, 'ammer along the 'ard 'igh road," there is not one word, except perhaps "ayn't," which, according even to the worst Cockney dialect, will bear the extra or exaspirated "h." An average reporter in an American paper would certainly write the sentence, "Hit hayn't the 'unting has 'urts 'im, hit's the 'ammer, 'ammer, 'ammer halong the 'ard 'igh road," which would be quite wrong. It will be news to many (especially in America), I suspect, but it is the simple fact, that the exaspirated "h" is not only limited in its use, but is often recognised in a word which *requires* an aspirate. Nay, one can recognise one whose aspirations are a recent and, as it were, artificial development by the way in which he aspirates the "h" in such words as "house" and "horse." I have a friend, a well-read man, unfortunately sent by his father to schools where it was not thought worth while to be strict about the "h's," who avoids the use of the "h" in words where he knows it should be used, because he is conscious that an exaspirated "h" where an "h" is needed sounds worse to practised ears than an "h" dropped altogether. When a friend asks him why he does not aspirate his "h's," knowing, as he does well, where they are wanted, he will say, "Oh, *h-h-hang* your aitches!" in a way showing that it is not for want of aspirational power that he drops them.

The writer in the *New York Tribune* makes the preposterous statement that the Englishman of the upper ten thousand objects to the correct use of the letter "h" by servants and small tradesmen. There may be occasional snobs who express such a feeling, though I have never come across any; but such cases must be altogether exceptional. So far from having any feeling of this sort, an English man or woman of the so-called upper class will often show undue condescension for those who blunder over their "h's" by correcting mistakes somewhat too pointedly. I know that many of the kindlier sort—the really better sort in the so-called upper classes—are often divided in their mind between their fear of offending servants by correcting wrong "h's" and the wish to set them right. Some of the less-cultured are very touchy about such correction; others have sense enough to invite it.

The same writer, whose letter was in fact a congeries of blunders, dwells on the entirely correct use of the "h" in England among the well-educated classes. But in England our "whys" and "whens," our "whiches," "wheres," and "whethers," are much too apt to be confounded with "wise" and "wens," with "witches," "wares," and "wethers." So widely is the fault spread that many of our educational authorities insist on "w" for "wh" as correct. A generation or so ago this was not the case, and a well-educated man would as soon have said "Vot's o'clock" as "Wot's o'clock." In America, careful though Americans are about the letter "h," the distinction between "rhyme" and "rime," "Rhode" (Island) and "road" is not so constantly attended to as I had expected.

Throughout the whole English-speaking community the original sound of "h" after "t" and "d," has long since been lost. As the very existence of the two sounds we now represent by "th" serves to show us, there is no connection whatever between the sound of "th" in "thought" or in "that" and an aspirated dental. I should have mentioned Ireland, however, as an exception, for there we still hear the old sounds in "d'his and d'hat," "t'ought" and "t'ousand."

I am satisfied the aspirate originally had a guttural sound in the English, as probably in other languages—at least in many words. Otherwise we should not find "horn" and "corn" associated in English (or "horn" representing "cornu") any more than we should find the Latin "hortus" related to the Greek "chortos" on the one hand, and our own "garden" on the other. What was the sound which the Anglo-Saxons represented by the spelling "hwat"? I fancy it was a sound such as we still hear in parts of Ireland, where in sharp or ejaculatory inquiry the word "what?" sounds almost like "quhat." It is well known that in old Scottish our "wh" is nearly always written "quh." Again, the undoubted guttural in the old sounding of "light," "sight," &c., was represented in Anglo-Saxon by the letter "h" alone, in the strange spelling, "liht," "siht," &c.

STUDIES WITH A SMALL TELESCOPE.*

IT does not seem to us just that this admirable little treatise should be left unnoticed in these columns merely because the greater portion of the matter first appeared in Knowledge. Even if the plan and scope of the treatise had been suggested by the editor of Knowledge, there would still be room for remarks on the way in which the work has been done. But as a matter of fact, the plan of the work was as entirely Captain Noble's as the execution has been.

We regard this book as one of the best introductions to

* "Half-hours with a 3-inch Telescope." By Captain W. Noble, F.R.A.S. Longmans & Co.: London.

telescopic work extant. To use an American expression, it fills the bill, and it does not more than fill it. Other works there are which contain either too much or too little—that is, considered with reference to the wants of the astronomical student. Here there is enough to occupy the attention of the amateur astronomer, while there is not enough either to deter him, by suggesting the idea that an immense number of objects must be studied before he can be regarded as having fairly entered on astronomical research, or to engage him in the time-wasting work of studying multitudinous objects of the same class with no special purpose in view. We happen to know that quite a number of intending students of astronomy have been driven from the proposed pursuit by the mere aspect of works in which multitudes of insignificant lunar details, thousands of records of planetary observations, and myriads of measurements of close double stars are recorded as matters worth studying. Many times we have been told that astronomy cannot be worth studying (outside official observatories for commercial astronomy) if for proficiency it requires its students to devote days, months, and years to

> Collecting toys
> And trifles for choice matters, worth a sponge;
> Like children gathering pebbles on the shore.

Now in Captain Noble's book just about as much attention is directed to each subject as it fairly deserves, and this has been done in such a way as to attract instead of repelling the student. A student who works through the series of observations described or suggested here will have done fully as much as is necessary to prepare him for serious work if he is able or inclined to enter on it. On the other hand, should he be content, as most men must be, to regard astronomy merely as a department of scientific study, he will not feel that he has given more attention to the subject than it fully merits. He will have derived much pleasure from the work of observation, his views will have been enlarged, and a measurable addition will have been made to the value of life. (We take it the chief value of scientific research outside definite gains from nature, resides in the answer which the study of truth gives to the vain yet persistent question, "Is life worth living?")

The introductory matter on the telescope is excellent, though it might be usefully supplemented by certain instructions which the beginner nearly always requires before he can get a telescope to work satisfactorily. In particular, the telescopic study of the sun requires some limits which Captain Noble has omitted to supply. His suggestion that to diminish the risk of the dark glass cracking, the aperture of the telescope should be reduced from three to two inches is sound enough so far as safety is concerned; but the plan involves a very serious diminution of defining power. The chapter on the moon is admirable, infinitely better calculated to attract students to the telescopic study of our satellite than the big but disheartening treatises mentioned by our author. We are glad to see by the way that he has put his foot down very definitely in the matter of lunar nomenclature. Four hundred names appear in the map and accompanying list, and surely four hundred are sufficient. A study of the moon involving the examination of more and minuter objects may be aptly compared in value to the enumeration of individual hairs upon the tail of the conventional cow. This we know would have seemed rank heresy to that dear old lady Mr. Birt, and will be rejected scornfully by his selenographical successors; but we shall wait until their elaborate work has added one single live fact to astronomical knowledge before we admit that we have erred.

We note only one point in the chapter on the moon which is open to question, and that does not belong to the subject proper of Captain Noble's treatise. He mentions as an inexplicable fact the notable darkening of the floor of Plato towards and until shortly after the time of full moon. We venture to deny that any such darkening takes place; and we are sure that if Captain Noble will follow our own method of testing the matter, using a Dawe's eye-piece or other device for getting rid of the effect of contrast, he will be satisfied that his inexplicable fact is a very readily explicable illusion. There is, however, a very simple proof of this in lunar photographs. We possess a very fine series of twelve photographs by Rutherfurd, showing the moon in all her phases. A careful comparison of these shows unmistakably that the floor of Plato grows lighter, not darker, as the sun's altitude above it increases.

The chapters on the planets are excellent. They are as interesting as the corresponding chapters in the first edition of Webb's "Celestial Objects:" before that work was overloaded with uninteresting details, and so deprived of much of its effective value. We observe that Captain Noble gives the rotation-period of Mars as 24h. 37m. 22·735s. We doubt very much whether Mr. Proctor ever attached any real value to the second and third decimal digits. The only thing proved about the rotation of Mars is that in which Mr. Proctor and the late Professor Kaiser of Leyden agreed—after the correction of two clerical errors of Kaiser's. Comparing the observations made by Hughens and Hooke with those made in the years 1864 to 1882, the rotation period of Mars has been shown to be 24h. 37m. 22·7s., within certainly less than 0·05s. either way.*

The treatment of double stars in the chapter on "Fixed Stars and Nebulæ" is admirable. Fifty double stars or so, including all the typical varieties, are described and pictured—enough to interest and instruct, not enough to weary. In fact, with so simple and attractive a way of presenting the subject, as many more might have been introduced, and no harm done. Yet we are glad that Captain Noble resisted the temptation; for though the student might have gone on unwearied, he has, as it is, been taught the useful lesson, much needed in such matters—*ne quid nimis*.

We do not care to note trifling *corrigenda* or defects in a work so excellent as a whole as this. We may mention, however, that the method of drawing ellipses with pins and a thread is not worthy of a place in Captain Noble's book. With far less trouble than the student would have to take in getting his pins rightly placed and the string of the right length, a much better ellipse may be drawn. We speak with some experience, having drawn many thousands of ellipses. The construction for representing the gibbous phase of Mars (see pp. 81, 82) is not quite correct: it is better to give the true elliptical form to the terminator. One other slight suggestion we would offer. It may seem hypercritical, but we somewhat object to the description of Mr. Ward's unusual keenness of sight as "almost supernatural" and "quasi-miraculous." It is exceptional, possibly unique; but the terms used by Captain Noble imply that it is not merely marvellous in degree (as assuredly it is), but in kind (which assuredly it is not).

* Others have since pretended to correct this by combining later observations with the mean of other estimates, including Kaiser's two estimates *before* the clerical errors were detected. But this last mistake is manifestly absurd; and though each succeeding opposition of Mars must necessarily enable us to improve our estimate of the planet's rotation period, half a century at least must pass before any correction amounting to one-twentieth of a second can be introduced in this way. The estimates of William Herschel, Mädler, Secchi, and Schmidt were less exact than Proctor's and Kaiser's (which were practically identical), but they were independent: those proffered by Messrs. Denning and Bakhuysen have no independent value whatever.

XUM

BIRTH AND GROWTH OF CHRISTIANITY.*

READERS of KNOWLEDGE, since the first monthly number appeared, will find much to interest them in Mr. Janes's excellent, carefully thought out, and well-written treatise on the early history of Christianity. He presents much of the evidence to which we have only directed readers' attention, not having here had space fully to consider it. He has also collected much matter on which, in our treatment of the subject, we have not hitherto touched.

The guiding idea of the work before us is that conveyed in the maxim of Confucius, that "The superior man does not set himself either *for* anything or *against* anything; what is *right* he will follow"; and again in the terser text of Paul, "Test all things; hold the good."

After a brief introduction, Mr. Janes sketches the condition of Palestine in the Roman period, and the society and religion of the Roman Empire. In the first of these chapters he presents, *inter alia*, interesting matter relating to the Essenes. Though inclining to the belief, which we must confess we do not share, that the doctrines and practices of the Essenes originated in Palestine by a natural evolution out of Pharisaic Judaism, he admits that obviously Eastern notions, chiefly of Zoroastrian origin, had been gradually creeping into the thought and faith of Israel. The penetration of Buddhist ideas to the more earnest of the Pharisaic separatists, after a process of filtration through Zoroastrianism, seems to us a far more reasonable explanation of Essenism than any process of evolution from Pharisaic Judaism.

In the account of Religion in Rome, perhaps the most interesting matter is that relating to oriental influences. The success of the worship of Mithra, when introduced by the Emperor Commodus towards the close of the second century, is full of significance, especially when associated with the influence which the worship of Serapis had had on the Romans during two preceding centuries. Renan goes so far as to say that, "Had not Christianity taken the lead, Mithracism would have become the religion of the world." It is not absolutely certain, however, that the Christianity which actually did find favour among the Romans, or at any rate the ritualistic part of such Christianity, was not simply the disguised worship of Serapis—that is to say, sun worship, and therefore Mithracism in another form. Mr. Janes mentions, though with little idea apparently of the significance of what he notes, that

> Even after the secular ascendency of Christianity the ritualistic worship of Mithra was handed down from age to age through the esoteric order of the Rosicrucians and the secret societies of the Middle Ages. The ceremonies observed in the worship of Mithra are described by Tertullian, a Christian writer of about 200 A.D., as strongly resembling the sacraments of the Church. The initiates were admitted by a rite of baptism. They worshipped in little chapels, similar to Christian churches. They made use of a species of eucharist, eating the sacred bread, draŏna, accompanied by solemn religious ceremonies, while the neophyte was tested by twelve consecutive penances. As in the Eleusinian Mysteries, the doctrines of a life after death, the resurrection of the body, and a future state of rewards and punishments, were taught by Mithracism. The influence of this new religion upon the thought and literature of the time was absorbing and all-persuasive.

The Gnostics doubtless borrowed largely from Mithracism; and the popular sects of Judaism are also thought to have derived many of their rites and doctrines from kindred mysteries, through Babylonia. The indirect influence of these conceptions upon the current and subsequent development of Christian doctrine was doubtless considerable. The leading Mithraic festival, celebrated at the winter solstice, identical in time with the Roman Saturnalia, was ultimately assimilated by Christianity, and recognised as commemorative of the birth of Jesus, which the apostolic tradition had assigned to the spring-time instead of the 25th of December.*

Further on Mr. Janes makes the following pertinent remarks on the position of religion in the West and in the East nineteen centuries ago :—

> Rome, with her State religion—a hollow ecclesiasticism to the more intelligent—stood ready, at the demand of self-interest, to dethrone Jupiter, and to pass over the temples of her gods, her images, her festivals, the paraphernalia of her priests, and the title of Pontifex Maximus, then held by Cæsar as the head of the Pagan cultus, to that new religion which, through the supremacy of the empire among the nations of the world, was soon to make such mighty strides toward universal dominion. Her sculptured heads of Jupiter were to descend to posterity, rechristened by the name of St. Peter, and her little god Vaticanus, whose function it was to watch over the first lisping of infants, was to bestow his name upon the Vatican—the palace of the Christian popes. The great Aryan monotheism of Zoroaster had met in Babylon the great Semitic monotheism of the Hebrew prophets, and, together with some more questionable benefactions, had blessed it with its gift of a belief in a life beyond the grave, and thus prepared the way for one of the leading doctrines of Christianity. The word "Father" as applied to the Supreme Being had entered Judaism from that other contact with the Aryan races through the Greeks, and was used by Jewish Rabbis of the century preceding the birth of Jesus. The Hebrew doctrine of the Messiah had taken a new and more personal form under the influence of contemporary Persian notions, and the stimulus of foreign oppression. Millennial expectations imported from Babylon were "in the air." The writers of the Book of Daniel and the apocryphal Book of Enoch had applied the term "the Son of Man"—a common designation of the prophets—to designate the coming Messiah. Hillel had already proclaimed the "golden rule" ("Do not to others what thou wouldst not they should do unto thee") as the substance and foundation of Judaism.

These two chapters are only introductory to the body of the work, in which the subject of the origin and progress of Christianity is very fully and fairly considered. Mr. Janes, while pointing out the impossibility of reconciling the narratives in the three first Gospels, even with each other, and the complete incongruity of the fourth Gospel, manifestly the work of a Gentile Gnostic, admits as genuine much more of the specifically historic matter in the Synoptic Gospels than we can for our own part accept. But he gives his reasons, and shows how he has weighed them: he does not mislead by dogmatic assertion. Of course he rejects as manifestly developed from the solar myth the whole account of the birth and youth of Christ.

The following passage presents the general result to which Mr. Janes has been led in regard to the character, the opinions, and the views of the founder of Christianity :—

> We have attempted, fairly, with no bias of preconceived opinions, to set forth the leading features in the teaching of Jesus on its theological side, as reported in the Synoptical Gospels. While recognising the fine humanity of his doctrine of the fatherhood of God and the profound sincerity of all his beliefs, there is evidently much in this teaching which the liberal and cultured thought of modern times has for ever discarded, much that bears the impress of a primitive and ignorant age and of a narrow and restricted intellectual environment. For us there is no encompassing host of demons, no personal prince of evil, no bodily resurrection, no eternal kingdom of immortals to be established upon the earth. If we still hold to the fatherhood and personality of God, it is in quite a

* "Primitive Christianity." By Lewis G. Janes, Index Association, Boston.

* The cross was a Mithraic symbol long before the advent of Christianity. It also constituted one of the eight altar implements of the Buddhists, and from very early times had been recognised as the sacred symbol of the god Nilus in Egypt. It is also of frequent recurrence in those buried cities of the Troad which Dr. Schliemann has recently exhumed.

different sense from that embodied in the simple, anthropomorphic conception of Jesus. The Messianic doctrine of the Jews is to us a beautiful dream, which the Prophet of Nazareth did not fully realise either according to the popular expectation or his own more spiritual interpretation. Not in any of these theological conceptions do we find the secret of the influence of Jesus upon the life and thought of later generations.

THE "SATURDAY REVIEW" ON BEECHER.

NOTHING more discreditable to English journalism has appeared for years than the attack made by the *Saturday Review* upon the memory of America's great preacher, Henry Ward Beecher. It is not known in America so well as it is in England that such attacks in English journals have in reality been directed against Beecher rather as an advocate of a policy not now fashionable in the old country, than against Beecher, the "lapsed Congregationalist" (whatever intensity of reproach those "very bitter words" may imply). Americans, thus ignorant of the real meaning of the attack, can only wonder that the editor of a paper pretending to any position in respectable journalism should have allowed an article to appear which, apart from the bad taste shown in every line, is so inanely irate that its venom is neutralised by its folly.

If Mr. Beecher had been the feeblest preacher or teacher that had ever addressed a congregation, if he had been even the offensive blasphemer imagined in the *Saturday Review*, it would have been grossly offensive to dwell on such shortcomings at a time when his own people were mourning his loss. But Beecher was a man of whom America was justly proud. What was said of him in the *Saturday Review* might unfortunately be very truly said of many preachers in America, as it might be said of many in the old country. Too many preachers in both countries have striven to obtain a false popularity by vulgar tricks, by coarse buffoonery, and by scarcely veiled profanity. But Beecher was never one of these. The *Saturday Review* even mistakes (if it does not wilfully mis-state) in suggesting the idea that Beecher strove to attract his audiences by pulpit-jesting. The touches of humour which may be noted in his sermons, as reported or written, are characteristic enough, it is true, but he appealed always to the reasoning faculties of his hearers, not to their sense of fun or to their love of amusement.

Each Monday the leading papers in the United States publish the sermons of those who are regarded, rightly or wrongly, as the leading American preachers. The bulk of such matter is very poor reading. Most of the sermons thus published are vulgar or silly or offensively unchristian. A paragraph or two from one of Talmage's sermons will more than nauseate a reader of average taste and intelligence by its disgusting imagery, its charnel-house metaphors, its illustrative references to ulcers, cancers, putrefaction, and other unseemly matters. The vulgarity of the much-followed "Sam Jones," his amazing self-sufficiency, and the way in which he condemns to eternal torments all who differ from him, cause even less than a paragraph of his sermonising to thoroughly sicken all but the strongest-stomached reader. And though others among the preachers are not so bad as these, few manage to preach or to write sermons which any one of taste or culture can read with patience. But everything Beecher allowed to appear in this way was worth attentive study. He was never dogmatic or overbearing. He did not even seem to desire to teach his hearers what they should believe or do. Always his tone was as of one striving after the truth. He seemed rather to ask, "Ought not *we* to think and act thus?" than to say, "*You* ought thus to believe, and by these rules to guide your conduct."

I have myself so intense a dislike to the usual tone of preachers that my opinion of a man in Beecher's position would be apt to be somewhat influenced by prejudice. I recognise in myself here an idiosyncrasy which would tend to make me unfair towards preachers generally, though I can maintain conscientiously the position that in the great majority of cases preachers, by the mere fact that they deem themselves competent to teach other men their duty, are objectionable in the sense in which the Pharisees seemed objectionable to the founder of Christianity. But Beecher belonged to that small minority among preaching men who, while they possess great power of exposition and persuasion, are more anxious to seek out the truth for themselves than to convince their fellow-men. Herein I take it lay the charm of his teaching and the secret of his influence, though I can only guess this by reading his sermons, having never heard him preach.

The *Saturday Review* quotes two passages from Beecher's sermons as showing such inanity that to compare him even with Mr. Spurgeon needs apology, which it proffers; and we all know what intensity of spite an apology from the *Saturday Review* implies. One of these passages is admittedly taken away from the context, and is thus so altered in character as to be unmeaning. The other affords a rather curious illustration at once of Beecher's turn of mind and of the mistake into which the *Saturday Reviewer* has fallen (let us charitably suppose) in treating him as a humourist of the pulpit. Said Beecher, speaking of Colenso's inquiries into the Pentateuch, "What if there are mistakes in the books ascribed to Moses? If there are, the mistakes are there; that is all. What if it shall be proved that Moses did not write those books? Then it is proved that he did not write them; that is all. What if some of the books which have been by many men considered divinely inspired, must be otherwise regarded? Then we must not deem them God's word; that is all. And what are we to say of those that are still left? We must accept them as still left us; that is all."* If this were the beginning and end of an argument, it would doubtless be unsatisfactory, except for hearers quick to apprehend the underlying meaning. But the words quoted form only part of a very characteristic piece of pleading. Beecher appeals to men to accept the truth as they see it, without the fear (implying want of faith) that the truth can do them harm. Underlying his appeal, we see the recognition of the way in which many weakly strive to blind their eyes to the truth. Beecher urges men to be less timid. Oh ye of little faith, he seemed to say, wherefore do ye fear? Why must you wish to offer to God the unclean sacrifice of a lie? That Beecher practised what he thus taught, and that he suffered for so doing, is well known in America. The coarse abuse of science, and especially of the doctrine of evolution, in which Talmage and his fellows revelled, was undoubtedly much more profitable for them than Beecher's ready, and even reverent, recognition of demonstrated truths. But the judgment of all the better sort of men approved the faithful honesty of Beecher, impolitic though it doubtless was, and scorned the pretended earnestness of hypocrites.

On one other point let me touch but for a moment. It has been asked with much derisive sneering, how America

* The *Saturday Review*, speaking of this passage, says it declines to recognise in it a specimen of American humour. As reasonably might it be said of American wheat that it cannot be regarded as good tobacco.

XUM

can love and reverence a man whose name was darkened by an accusation never wholly disproved. I know not by what right a charge not wholly disproved can be urged against a man's memory as though it were an accusation fully proved. Even had the charge been proved, however, it would have been one involving no such deliberate iniquity, and suggesting no such innate depravity, as average minds find in the conduct of one who (we are told, and many believe) was loved above all other men by God. If God could condone David's greater guilt of kindred nature, covered (to men's eyes) by deliberately planned murder, men may surely forgive the lesser offence, which for the moment is assumed to have been committed by Beecher. But it is worthy of careful consideration that while doubtless many thousands in America believe that Beecher was guilty in that matter, the proportion of those who utterly reject such belief is found to be greater the nearer we approach the centre of his ministry. At that centre all believed and believe in his innocence, seeing only the plots of enemies in the attack upon his character.

THE LOUISIANA LOTTERY.

By Richard A. Proctor.

THE greed for chance-won wealth is so great among men of weak minds, and they are so large a majority of all communities, that the bait may be dangled for them without care to conceal the hook. In all lotteries and gambling systems which have yet been known the hook has been patent, and the evil it must do if swallowed should have been obvious. Yet it has been swallowed greedily.

A most remarkable illustration of the folly of those who trust in luck, and the cool audacity of those who trust in such folly (with more reason but with more rascality) is presented by the Louisiana Lottery in America. This is the only lottery of the kind now permitted in America. Indeed, it is nominally restricted to the State of Louisiana; but practically the whole country takes part in it, tickets being obtainable by residents in every State of the Union. The peculiarity of the lottery is *the calm admission, in all advertisements, that it is a gross and unmitigated swindle.* The advertisements announce that each month 100,000 tickets will be sold, each at five dollars, shares of one-fifth being purchasable at one dollar. Two commissioners—Generals Early and Beauregard—control the drawings; so that—we are told, and may well believe—the drawings are conducted with fairness and honesty, and in good faith to all parties. So far all is well. We see that each month, if all the tickets are sold, the sum of 500,000 dols. will be paid in. From this monthly payment we must deduct 1,000 dols. paid to each of the commissioners, and perhaps some 3,000 dols., at the outside, for advertising. We may add another sum of 5,000 dols. for incidental expenses, machinery, sums paid to agents as commission on the sale of tickets, and so forth. This leaves 490,000 dols. monthly if all the tickets are sold. And as the lottery is "incorporated by the State Legislature of Louisiana for charitable and educational purposes," we may suppose that a certain portion of the sum paid in monthly will be set aside to represent the proceeds of the concern, and justify the use of so degrading a method of obtaining money. Probably it might be supposed that 24 per cent. per annum, or 2 per cent. per month, would be a fair return in this way, the system being entirely free from risk. This would amount to 9,800 dols., or say 10,000 dols., monthly. Those who manage the lottery are not content, however, with any such sum as this, which would leave 480,000 dols. to be distributed in prizes. They distribute 215,000 dols. less, the total amount given in prizes amounting to only 265,000 dols. If the 100,000 tickets are all sold—and it is said that few are ever left—the monthly profit on the transaction is not less than 225,000 dols., or 45 per cent. on the total amount received per month. This would correspond to 540 per cent. per annum if it were paid on a capital of 500,000 dols. But in reality it amounts to much more, as the lottery company runs no risk whatsoever. As I pointed out recently, in the *Newcastle Weekly Chronicle*, the Louisiana Lottery is a gross swindle, besides being disreputable in the sense in which all lotteries are so. What would be thought if a man held an open lottery, to which each of one hundred persons admitted paid 5*l.*, and taking the sum of 500*l.* thus collected, were to say: "The lottery, gentlemen gamblers, will now proceed; 265*l.* of the sum before me I will distribute in prizes, as follows" (indicating the number of prizes and their several amounts); "the rest, this sum of 235*l.*, which I have here separated, I will put into my own pocket" (suiting the action to the word) "for my trouble and expenses in getting up this lottery." The Louisiana Lottery is a transaction of the same rascally type—not rendered more respectable by being on a very much larger scale.

If the spirit of rash speculation will let men submit to swindling so gross as this, we can scarcely see any limit to its operation. Yet hundreds of thousands yield to the temptation thus offered, to gain suddenly a large sum, at the expense of a small sum almost certainly lost, and partly stolen.

THE NATURALIST'S LABORATORY.

CONTRIBUTION VII.

Laboratory Furniture—(*concluded*).

THE student's workshop cannot be regarded as even fairly well equipped unless adequate provision is made for the convenient storage of specimens, the reception of books and instruments, and the temporary sheltering of work in course of progression. Cabinets, cases, and boxes, to meet each special want, are thus found necessary, and it is therefore incumbent on us to point out or describe the forms of the articles best suited to the naturalist's requirements.

The old-fashioned cabinets replete with drawers, and trays within the latter, can scarcely be improved upon for holding geological or dry biological specimens. Each drawer can be numbered and indexed with a list of its contents, and when the trays are removed and placed upon a table they show at a glance the various objects, which may be displayed with as much effect as in the wall cases of a public museum. Such cabinets ought to form the basal moiety of the storage area, as shown by the accompanying sketch, fig. 1. The upper portion of the case may conveniently be reserved for holding cases of instruments, such as dissecting tools, microscopes, &c., in a large box made to stand upon the top of the chest of drawers, and provided with a hinged lid to open upwards, as shown in the side plan, fig. 1, *a*; the dotted line shows the position of the opened lid. Upon the top of this instrument case there should be piled a series of narrow boxes, c, fig. 1, each one of which should be faced with a glass door hinged to its upper edge, and made to open outwards and upwards, as indicated by the dotted lines *bbb*, in the side plan (fig. 1). These boxes will be found invaluable for the permanent

places of such articles required for constant use or reference, and which are liable to be affected or destroyed by even a nominal accession of dust; *e.g.*, the microscopist's bottles of mounting media, staining reagents, spirit lamps, the boxes used for the storing of microscopical slides, &c., the best form of which will be detailed presently. The component parts of the entire structure should be fastened together with screws and bolts for the sake of firmness. It need scarcely be added that the composite structure thus built up may be made of any size to suit the particular wants of any special laboratory, but the dimensions given on the annexed diagrams will be found of service in nine cases out of ten. The front elevation shows three such cases placed side by side, from which it may be gathered that, as the stores within the laboratory increase, the dimensions of their future homes can as readily be added to. Again, as each box (C, fig. 1) is complete in itself, it may at any time be removed and replaced by one of greater or less

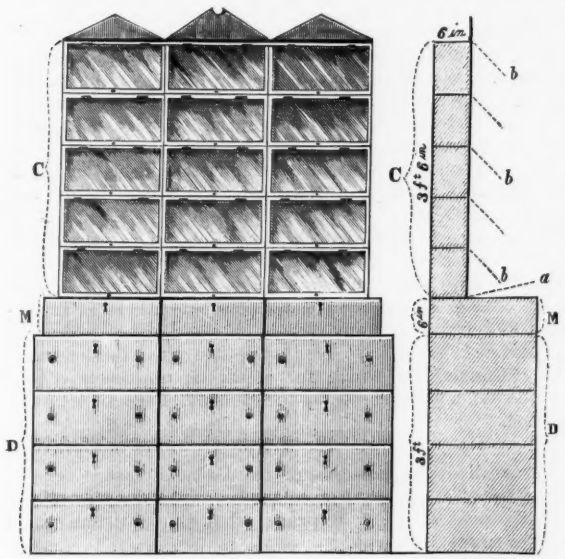


FIG. 1.—THE NATURALIST'S STORE CASE.
C, upper boxes; M, instrument box; D, specimen chest; *a*, position of lid of instrument box when opened; *b b b*, position of lids of upper boxes when opened.

height. Apart from the portability of the structure, this device is better calculated to guard against the incursion of dust and dirt, which, as has before been noted, is of primary importance to the practical students of nature. A large box, constructed upon the book-case principle, with adjustable shelves and large doors with panels of glass, will not be found more convenient for ready access as may upon first thoughts be imagined, and is furthermore prone to the collection of quantities of dust which would necessitate frequent and laborious cleansings. With the portable boxes each set of appliances can be separately kept, easily replaced, and each compartment can be separately wiped out as occasion may arise. Another important advantage to be gained by the adoption of the plan is, that the worker can construct his own cabinet piecemeal from time to time, with but very little skill, and at a very trivial expenditure. The author was led to devise it gradually: he first of all commenced by placing a series of small rough wooden boxes, such as can be procured from any grocery or oilman's stores, at the cost of from one to threepence a piece, one over the other, upon a cheap chest of bedroom drawers. Certain of these boxes were set apart for microscopical requisites, such as Canada-balsam phials, spirit lamps, porcelain dishes for sections in course of preparation, &c., all of them necessitating a dust-proof yet easily accessible lodging; and these were accordingly provided with small panes of glass framed, and hinged upon the upper edge of each box. The central case for instruments soon suggested itself, and an "egg-box" was found which exactly fitted upon the top of the chest of drawers, which were then all filled with geological chips. With but scanty skill and a little taste the whole case may be rendered a handsome piece of furniture, worthy of a well-appointed laboratory. The insides of the boxes may be lined with pieces of white cardboard, and their ungainly edges covered by a neat framework made of picture-frame mouldings, sufficient of which can be procured for a few pence. The cabinet of drawers, placed lowermost, may also be made upon the portable plan, and the trays full of specimens be virtually adapted from empty "soap-boxes," provided with framed glass lids, and divided into suitable compartments within for each separate specimen. The soap-boxes thus utilised can then be merely piled one over the other loosely within each larger box, which forms an integral part of the whole lower case. By degrees, all the available floor-space adjoining the walls of the apartment can thus be utilised to the best advantage, and there will thus be afforded a highly suitable place for everything likely to be required in the laboratory.

By a modification of the portable upper boxes into ordinary cases of large size, fitted with adjustable shelves, ample space will be provided for such books, pamphlets, and papers as the worker may possess which bear upon the subjects of his studies; and similar shelves can be set apart whereon to place bottles and jars containing specimens for display, or working material, such as plants and animals in spirit, &c., mounted osteological and other preparations under glass domes or cases, &c.

One case of upper shelves may be set apart to hold microscopical slides, upon the following improved principle:—Take, for example, a collection of preparations illustrative of the *Rhizopoda*. A small typical series may be contained in two book-boxes labelled respectively *Foraminifera* and *Radiolaria*, placed endwise, as usual with printed volumes, upon a shelf. Each box, to take the English standard sizes, may be made to hold either twelve or twenty-four slides, in an ordinary rack work within. When the boxes are placed upright upon the shelf, the slides will be *horizontally* disposed, and thus run no risk of displacement of the objects, by gradual subsidence, as sometimes happens when the same boxes are laid flat upon a table. An index of contents may be fastened upon the inner side of the lid of the box, and with a little care the student will soon fall into the good habit of numbering each preparation, and always placing it in the slit corresponding to that number upon the index. By the adaptation of a simple movable wire, hooked at each end, and capable of adjustment within eyelet holes, one at each extremity of the box, as graphically explained by fig. 2, a holdfast will be obtained, which can be removed and readjusted with the utmost facility, secures each slide in its place, and prevents it effectually from falling out of the box, even when the latter is carelessly or suddenly opened. The advantages of such a system are undeniable; the specimens are held firmly in a horizontal position, a *sine qua non* in the storage of such things, and any object desired can be found at a moment's notice by a reference to the outer title on the back edge of the box, and a glance at its table of contents affixed to the inside of the lid. The

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forms of microscopical cabinet now in common use are, many of them, both cumbersome and inefficient. The large handsome boxes with their sliding trays, it is true, keep the slides in a horizontal position, but that is about all. The author was once the unhappy possessor of a piece of furniture of this sort, but got rid of it on account of two very grievous faults. The sliding trays, after exposure to unlooked-for damp, became slightly warped, and every time that they were withdrawn or forced home a considerable amount of jerking was occasioned, and terminated fatally

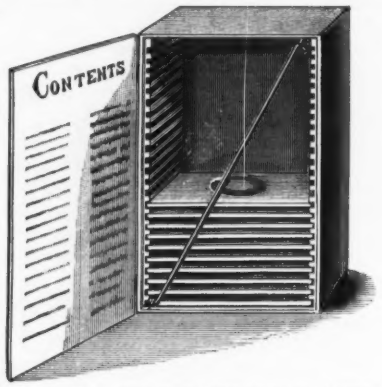

Fig. 2.—Book Box for the Storage of Microscopical Specimens.

for some of the choicest preparations within; they were thrown one upon the other, and became inextricably united. Every time the ponderous case was moved the slides had to be shifted into rack-boxes temporarily and then carefully rearranged in the cabinet on arrival at the new destination; a labour by no means pleasant nor easy of performance when the cabinet is a large one and well filled. Ordinary small pine or mahogany cabinets, with divided lifting trays, are all very well for very small collections, and when sets of objects are to be carried away for displays, &c.; but their presence upon the laboratory table in anything beyond one or two cases is decidedly out of place, and most emphatically "in the way."

In addition to the furniture, properly so called, for the laboratory, there are various items which cannot either be classed under the heading now discussed nor as part and parcel of the instruments which call for a description in the future completion of these papers; they necessarily waver between the two, and will therefore form the subject of the next contribution as "laboratory requisites."

Gossip.

By Richard A. Proctor.

A Catholic (Roman) monthly magazine takes me to task, in somewhat schoolboyish fashion, for questioning the authenticity of the well-known passage in Tacitus, in which the Christians are described as malefactors justly punished as enemies of the human race, though so cruelly as to excite the sympathies even of those who recognised their wickedness. It has always appeared to me, from the time when, as a boy, I first became acquainted with this remarkable "evidence of Christianity" (to use Paley's ungrammatical expression) that the friends of Christianity would rather it were proved to be an interpolation than see it established as genuine. Paley says that the words of Tacitus *prove* that the founder of Christianity was put to death. If the passage is genuine, Tacitus *states* that one Christus suffered death in the reign of Tiberius, under the procurator Pontius Pilate. But since Tacitus was born at least twenty years after Tiberius died, and wrote his "Annals" more than thirty years after the destruction of Jerusalem, and more than seventy years after Pontius Pilate was ordered to Rome (A.D. 37, because of his harsh treatment of the followers of an impostor who misled many Samaritans), it is difficult to see how any statement of his about the origin of Christianity can be regarded as *proving* anything. If the passage is genuine, and a statement by Tacitus is to be regarded as affording proof demonstrative, then it must be regarded as proved that the Christians in the time of Nero

(1) were held in abhorrence for their crimes;
(2) were shown by their conduct to be veritably enemies of the human race;
(3) were held, even by the most tolerant, to be deserving the severest punishment.

* * *

Luckily there are abundant reasons for regarding the statement as of no weight whatsoever, whether a forgery or genuine. We know that at the beginning of the second century, when Tacitus wrote his "Annals," many related what his statement has been held to prove. He manifestly had his information, if he wrote that statement at all, from those who repeated what was currently said in his day about the events of the days of Nero (who died when Tacitus was quite a small boy). There was probably not a particle of real evidence to show that the Christians, who very likely were persecuted by Nero with the ferocity described by Tacitus, were really malefactors, or even generally said to have been so at the time of the persecution. It is impossible to imagine that any records (of the slightest real value as evidence) could have been accessible when Tacitus wrote his "Annals," by which the actual circumstances of the persecutions carried on by Nero could have been ascertained.

* * *

If such evidence as that of the doubtful passage is to be accepted at all, it must of course be accepted as it stands. If it proves anything, it proves what the Christian would prefer to see disproved.

* * *

The same Roman Catholic magazine recommends me to read Bekker's remarks on the manuscripts of Tacitus, to correct my judgment. But alas, that remedy can be of no use to me, for it has been already applied in vain. Nothing Bekker wrote half a century ago (my copy of his edition of Tacitus is dated Leipzig, 1831) can controvert the fact that the "Annals" of Tacitus have reached us in a most imperfect state, and that the genuineness of certain portions is open to the gravest possible doubt.

* * *

My critic volunteers further the information that the "Annals" were written in Latin, a language which admits of no distinction between "Christ" and "The Christ." I had had some inkling of this before. But the Latin language was not so utterly feeble that Tacitus would have been unable to show that the founder of Christianity was called "The Anointed." Had he been as well informed about the beginning of Christianity as Paley (for example) would have us believe, he would undoubtedly have said that the Christians were so called because the founder of their religion, a man named Jesus, had been called Christ, which in the Greek tongue signifies Anointed. To a monkish interpolator, accustomed—as we are in our own day—to speak of Jesus the Christ as simply Christ, nothing would be more natural than to write as Tacitus is supposed to

have written. But nothing could well have been more unlike Tacitus than to use a Greek adjective as a proper name, if he had really known anything about the history of the founder of Christianity. And if he did *not* know anything, or knew so little, what value can his testimony possess? What even can it prove, if accepted?

* * *

WRITING at this moment away from my books (in Florida, far from any large library), I cannot state precisely how far the version of the "Annals" discovered about the year 1505 in the Westphalian Abbey of Corvey differs from others. But it is hardly necessary to remind the reader that we only know of the first five books of the "Annals" from this version, published at Rome by Philip Beroaldus, in 1515, as nearly as I can recollect.

* * *

WHAT would be said, I wonder, if the confidence with which Paley accepts the statement found in Tacitus were extended to the passage in which the Emperor Hadrian, writing to Servianus (A.D. 134), after speaking with some contempt of Egypt and the Egyptians, says, "The worshippers of Serapis (in Egypt) are called Christians, and those who are (consecrated) to the god Serapis call themselves (I find) the Bishops of Christ."

* * *

MACROBIUS (Sat. i. 20) identifies Serapis with the sun. There were two forms of the worship of Serapis, a circumstance which led Jablonsky ("Pantheon," vol. i.) to identify what he regarded as the later form with the worship of the sun in the winter signs of the zodiac. But he was probably misled by the references in the Egyptian ritual to the observances at the time of the sun's annual birth (assigned to the date December 25, as the time when first the stay of the sun's southward progress was ascertained, and the beginning of his return towards the equator recognised). The worship of Serapis found attractions for both Greeks and Romans. But for some reasons it was regarded as evil, insomuch that, tolerant though the Roman Senate was in matters relating to religion, the worship of Egyptian gods was forbidden, and orders were issued that the altars and temples erected to them should be destroyed. Later the worship of Isis and Serapis was permitted. This was about a century before the time to which the passage attributed to Tacitus relates.

* * *

IT may be mentioned here, as at least curious if not significant, that Socrates the ecclesiastical historian ("Eccl. Hist." lib. 5, ch. xvii.), writes as follows respecting the temple of Serapis:—

"In this temple, now destroyed and everywhere rifled, certain letters were found engraved in the stones—forming a cross. The Christians and Gentiles who saw this, applied it each to their own religion. The Christians asserted that this cross symbolised the passion of Christ, and was the emblem of their religion. The Gentiles affirmed that in this symbol was presented something belonging in common to Serapis and to Christ."

* * *

THE critic who has explained to me that the "Annals" of Tacitus were written in Latin may now very properly explain to me that Socrates was a philosopher who, as he was born 469 years before the Christian era, can hardly be described as an ecclesiastical historian. However, the Socrates I have quoted was born about nine centuries later. Sozomen, about fifty years earlier, gave much the same account of the Egyptian Serapis. His history ranges from A.D. 324 to A.D. 439, that of Socrates from A.D. 306 to A.D. 439.

THAT the cross on our modern hot-cross bun is of Egyptian origin is of course known to all—see, however, Bonwick's "Egyptian Belief," and Colenso on the Pentateuch, &c. It is equally well known that originally this symbol had no connection with Good Friday, but belonged specially to every Friday, Friday being the day consecrated to Freya, Venus, Isis, &c.

* * *

HERE is rather an odd coincidence. I was beginning to deal with the solution of the second of the problems dealt with this month, when it occurred to me that the work would be easier if I had a number of globes which I could arrange as pyramids, either square based or triangular, according to the requirements of the problem. As the thought passed through my mind, I remembered that it was very close to post time, and I went out to post some letters I had written, thinking I would reason out a solution, or rather the best form of presenting one, as I walked to the post office and back. This was at Lake Weir in Florida. As I crossed the threshold of the hotel, I saw a friend approaching in a buggy, with whom I shook hands. He had in his left hand a sack about half full; and he said, "Professor, I've brought you a few (?) oranges." I thanked him, and after a short chat walked on to the post office—not thinking of my problem, because I knew the oranges would be just what I had wanted, and that I could study the problem much better with them to build into pyramids than without their aid. And so it proved. They were better than globes, because when stood on the stalk side they did not roll. I do not know what idea my friend had formed of my orange-eating capacities, but he had brought me enough to make two pyramids, one triangular, the other square based, each of four oranges in the side, and this after setting on one side all the smaller and all the larger oranges, so that only oranges of medium size might be used. Observe, also, that oranges were about in such profusion that I could find no one to whom I could present any. Moreover, I was to leave Lake Weir in two days, and my valise was very closely packed already. As a mere matter of fact, I may mention that I did not eat all those oranges.

Reviews.

Popular Tales and Fictions. By W. A. CLOUSTON. (William Blackwood & Sons.)—Mr. Clouston has done good service to folk-lore by the collection of the rich material garnered in these handsome volumes. We can readily credit that his chief difficulty in selection has arisen from the superabundance of that material, and the judgment which he has shown leads us to hope that he will continue his laborious but delightful work. His own modest assessment of it, and general abstinence from theorising, will secure him readier hearing for that which is added as comments upon, and conclusions from, the data presented. Mr. Clouston feels his way wisely, therefore cautiously, but, in so far as theories of the *origines* of folk-tales lead him, he inclines to the school of Benfey and Cosquin, which contends that for the most part those tales arose in, and were diffused from, India. We are as yet a very long way from the last word on this matter. Story-telling thrives in the East, but it also thrives wherever man has risen to the social state. Moreover, if we assume that the great body of folk-tale common to the Indo-European races has its source in the old Aryan home, we must remember that scholars are not agreed as to whether that home was in Europe or Asia. Neither can we tell how many older and foreign tributaries mingled with the main stream of grotesque fancy and uncultured

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imagination which fertilised the highways of human life in a pre-historic past. In considering this question, two things have to be borne in mind, one general, the other special, in its application. We find races at corresponding levels of culture explaining like phenomena in much the same way, and thus we may account for parallel lines of thought and striking resemblance in the myths and legends of races between whom no intercourse has been possible for unnumbered centuries, and we should therefore differ from Mr. Clouston in his exception of many tales even of common life, allowing for local differences, from this explanation. As to the special bearings of the question, let it not be forgotten that the Eurasian continent was peopled with races in no mean stage of culture long before Aryan and Semite attained historic prominence. It is on this older culture, which obtrudes or overlaps in many a persistent type of race and many an archaic belief, that the higher civilisation rests. Rich veins await the smelting fire of sober inquiry which shall extract the secret of their deposit, and to this work the efforts of students of human progress will, we feel persuaded, be increasingly directed. But we must not take leave of Mr. Clouston after this inadequate notice without heartily commending his volumes to the attention of all such workers, as also to a wider class, for the feast of good stories therein.

The Geological and Geographical Distribution of Animals. By Professor Angelo Heilprin. (Kegan Paul, Trench & Co.)—In this newest addition to the well-known International Scientific Series we have an excellent compendium of the facts of past and present distribution of animal life. The principles and phenomena of this distribution have received copious exposition in the important works of Wallace, Sclater, and other authorities, but science knows no finality, and Professor Heilprin has embodied enough fresh material to render his book welcome and opportune. He has made some essential alterations in the arrangement of the great zoological regions into which naturalists commonly divide the land area of the globe, and his book is enriched by an interesting discussion on the origin of the pelagic or deep sea fauna as the modified descendants of primary shore fauna. The important light thrown upon the theory of derivation by a study of the conditions determining the distribution of life is familiar to students of Mr. Darwin's works—in fact, as is well known, it was the observation of the fauna of the Galapagos Islands as compared with that of South America, the nearest mainland, which gave so great an impetus to his investigations.

Through the Fields with Linnæus. By Mrs. Florence Caddy. (Longmans.)—The title of this book led us to expect a ramble by flowery meads, whereas it turns out to be a prosy and padded account of the career of the great botanist. It is difficult to see for what class of readers Mrs. Caddy is catering, since her book is too tedious to interest the general reader, and too flimsy to be of service to students of the science in which Linnæus holds foremost place.

Woodland Tales. By Julius Stinde. Translated by Ellis Wright. (Fisher Unwin.)—The issue of this smooth and pleasant translation of Dr. Stinde's short sketches is probably due to the enormous success of his "Buchholz Family." But though his sketches are short, they are not slight; the workmanship in each is thorough, the subjects are all more or less touching, sometimes, as in "Brother Johannis," bordering on the terrible. The sombre scenery of the forest invests them; the weirdness and pathos of forest-life informs them; and the novel-reader, bored with the small talk and tedious analysis of much of the stuff which Mudie sends him, should read these "Woodland Tales" with fresh appetite.

Sonnets Round the Coast. By H. D. Rawnsley. (Swan Sonnenschein & Co.)—In these poetic seascapes Mr. Rawnsley has skilfully avoided the risk of monotonous treatment of that perilous subject—descriptions of the ocean—by availing himself of the rich significance of material which fringes our coast in historic relic of abbey, shrine, and grave; as well as of the equally suggestive material supplied by quaint tradition and heroic deed. The sonnets betoken a cultured mind, and are marked both by vigour and freshness of thought, as well as by grace of expression; notably so in those which have certain aspects of nature for their theme.

The Perfect Way; or, The Finding of Christ. By Anna B. Kingsford, M.D., and Edward Maitland, B.A. (Field & Tuer.)—This book is printed in type of remarkable beauty, and altogether produced in a style "regardless of expense." But what meaning may lie in it, if there be one at all, only astral spirits, such as the authors claim to possess, may fathom. To our terrene and unillumined mind it is a farrago of cabbalistic rodomontade.

A Concise History of England and the English People. By the Rev. Sir G. W. Cox, Bart., M.A. (London: Joseph Hughes. 1887.) — Admitting to the full the modest allegation in Sir George Cox's preface that "a history of England given in a few hundred pages must necessarily be a sketch," we must, in common fairness, add that he has shown how, in such a sketch, a large amount of really valuable historical information may be conveyed in a lucid and very readable form. A leading characteristic in his treatment of the events he describes, is his fairness and impartiality. Comparatively few clergymen, we venture to think, could be found to narrate the events of the reign of Charles I. in so absolutely calm and judicial a spirit as our author has done. He has produced a work of real value to the incipient student of the history of his own country.

The Making of New England. By Samuel Adams Drake. (London: T. Fisher Unwin. 1886.)—In a very simple, but not on that account less interesting manner, Mr. Drake, who is an American, tells the story of the colonisation of his native land, from the time of its discovery by Sebastian Cabot down to the date of the Confederacy of 1643. Copiously illustrated with maps, plans, views of localities, and engravings of people and objects of archæological interest, this volume may be read with profit and advantage by all who care to learn how slowly and painfully New England was peopled from the Old Country, and in what humble beginnings the vast American Republic had its origin. So far the tale has never been better told for educational purposes.

Joint Scientific Papers of James Prescott Joule, D.C.L., LL.D., F.R.S. Vol. II. (London: Taylor & Francis. 1887.)—Three years ago (Knowledge, Vol. V., p. 245) we reviewed in these columns the first part of the noble contribution made to the advancement of science by the Physical Society of London in the shape of their reprint of the scientific papers of our immortal physicist, James Prescott Joule. As we write, the second volume lies before us. In it we find the details of Joule's experiments on the mechanical powers of electro-magnetism, steam, and horses, made ostensibly in conjunction with Dr. Scoresby, but practically performed by Joule himself; his investigations, conducted with the aid of Sir Lyon Playfair, on atomic volume and specific gravity; and a mass of other researches, chemical and thermo-dynamical, the latter performed with the co-operation of Sir Wm. Thomson. Nothing is more striking than the absolute thoroughness of all Joule's work. It was this very thoroughness, and the scientific conscien-

tiousness of its author, which established its results on so irrefragable a basis and marked so very notable an epoch in the progress of physical science. These volumes will always possess an interest, as embodying the details of the researches of one of the most able and remarkable scientific men of the present century, and one who was in the truest sense of the word an epoch-maker in physics.

Geography made Easy. By JOHN GIBSON, M.A. Third Edition. (London: Relfe Brothers.) *Public Examination Scripture Manuals—St. Matthew's Gospel, St. Mark's Gospel.* By ARTHUR RICHES, F.R.A.S., F.R.G.S. (London: Relfe Brothers.) *The Musician: a Guide for Pianoforte Students.* By RIDLEY PRENTICE. Grade VI. (London: Swan Sonnenschein & Co. 1887.)—These are three educational works, each carefully and thoroughly done, and suited to the wants of the students whom they address. In the case of Mr. Prentice's work, such students must, however, be very advanced ones.

Home Rule "Wrinkles" for Ladies. By AUNT BETSY. (London: Swan Sonnenschein, Lowrey & Co. 1887.)—In this tiny manual "Aunt Betsy" gives a variety of very useful hints indeed to young wives, mothers, and housekeepers. Its trivial cost places it within the reach of all such, and is out of all proportion to the real value of its contents.

Easy Guide to the Principal Constellations and Stars visible in Great Britain. By E. W. (London: Griffith, Farran, Okeden & Welsh.)—This cheap little sheet forms a capital primer for familiarising the very beginner with the face of our English night sky. It is very well done, and will be found really useful by those who wish to learn the chief stars visible in this country.

The Artist's Manual of Pigments. By H. C. STANDAGE. Second Edition, revised. (London: Crosby Lockwood & Co. 1887.)—The commendation we bestowed upon the first edition of Mr. Standage's valuable practical work (KNOWLEDGE, vol. ix. p. 259) may be unhesitatingly extended to it in its revised and improved form. No painter's library can be held to be complete without it.

Suggestive Lessons in Practical Life. Fourth Series. (Smith & Elder.)—This volume completes a very useful series, and we are happy to extend to it the unqualified praise given to its predecessors. We have received from the same publishers Volume X. of the *Dictionary of National Biography*, on the rapid progress of which spirited undertaking we congratulate them. We have also to acknowledge a new volume of the "Book Lover's Library"; *The Dedication of Books*, by H. B. WHEATLEY (Elliot Stock), with its choice selection of some famous ancient and modern dedications, from Shakespeare downwards, to friends and patrons; *Immodesty in Art, a Letter to Sir Frederick Leighton*, by Rev. F. G. Lee, to whom we may commend Browning's "Parleyings" with Francis Furini; *Babies' Crawling Rugs, and How to Make Them*, by E. S. WINDSOR (Griffith & Farran)—homely and practical; *Jackson's Vertical Writing Copy Books* (Sampson Low & Co.)—a good idea well carried out; Part II. of the *Smithsonian Report*, 1884; *The American Naturalist*, in which is the opening paper of what promises to be a valuable series on the "Significance of Sex." Of papers in the current number of the *Century Magazine* everybody will read MARK TWAIN's amusing but humiliating paper on "English as She is Taught," and the discerning few will not skip Professor WHITNEY's article on the "Veda." *St. Nicholas* is up to its high average, and in *Longman's* Mr. RIDER HAGGARD keeps us at fever heat as to the fate of Allan Quatermain and his co-adventurers, while Mr. LOUIS STEVENSON gives a delightful sketch of an old Highland shepherd.

We have also on our table Dr. Richardson's *Asclepiad* (London: Longmans & Co.), with an excellent article of great popular interest on "Natural Selection for Science and for Art." *The Medico-Legal Journal*, New York. *The Journal of the National Fish Culture Association* (London: The Blackfriars Printing and Publishing Company, 1887), interesting to all concerned in the development of an almost unlimited source of valuable food. *Practical Hints on House Drainage* (London: The Scientific Publishing Company, 1887), useful to householders when sanitary arrangements are in any way defective; and the *Report of the Papers read and Discussions* at the Conference of the Camera Club (same publishers).

Our Chess Column.

BY "MEPHISTO."

INTERNATIONAL CHESS CONGRESS.

THE programme has been issued of the fifth biannual Congress of the German Chess Association, which will assemble at Frankfurt on July 17. There will be plenty of attractions in the shape of various minor tournaments for those amateurs who may wish to make the Congress an excuse for spending their holidays on the Rhine. The principal event, however, will be the International Masters' Tournament. The prizes are 50*l*, 37*l*. 10*s*., 25*l*., 15*l*., 10*l*., 7*l*. 10*s*. Conditions are, as usual, twenty moves an hour, play from nine till one and four till eight, three games to be played in two days, each player to play with every other, drawn games to count half, &c. There is also a prize of 5*l*. for the most brilliant game, generously given by Mr. F. H. Lewis.

I venture to predict that this tournament will prove a greater success than any former meeting. There are various causes which will bring this about, despite the fact that the prizes are small when compared with those given by the British Chess Association. If I may make use of a paradoxical assertion, I would say it is nearer for Englishmen to go from London to Frankfurt than it is for Germans to travel from Frankfurt to London. Frankfurt is centrally situated, and living there being cheap, many of the strong Viennese players will, no doubt, attend. Others, again, will go for the purpose of enjoying a holiday. But, in reviewing the chess masters of the day before our mind's eye, we have no doubt that there will be at least two of the young players in Berlin who will join the masters. The probabilities are that Herr von Bardeleben, of Berlin, and M. Tschigorin, of St. Petersburg—two players of the highest order—who did not compete on the last occasion at Hamburg, in 1885, may do so now. We may predict with certainty that M. Taubenhaus, from Paris, will participate, and, according to all accounts, he as well as the other rising players mentioned have greatly improved, and will make a stout attempt to wrest the laurels from the older and more experienced masters, the same as Gunsberg succeeded in doing in '85 at Hamburg. We hope to welcome another fresh chess competitor at these tournaments in Mr. Lipshutz, from New York, who made his first successful début at the B. C. A. meeting in London last year. England, if we are not mistaken, will also send her usual contingent of players, reinforced this time probably by Pollock and Burn, both players of high merit, who did not compete in any former masters' tournament in Germany. Zukertort may perhaps be induced to take part, for the simple reason that, where there is such a plethora of chess talent, a true chess-player will naturally be disinclined to allow himself to be excluded by mere monetary considerations. All these probabilities favour the assumption that the Chess Congress at Frankfurt will be a great success.

"THE CHESS PROBLEM."*

Of chess-books written in the English language it may well be said that many that are written are not desired, and a few that are desired are not written. The book before us is eminently a desirable work. It contains 400 problems, comprising 2, 3, 4, and 5 movers, suimates, and prize problems, the composition of the four eminent English problemists mentioned above. These form a valuable collection of fine problems, alike interesting to the lovers of problems

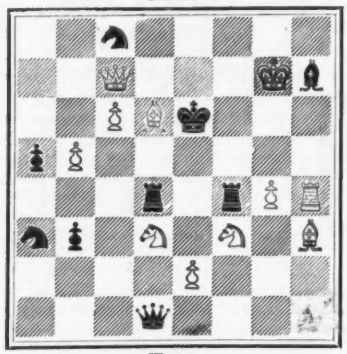
* Text-book with Illustrations containing Four Hundred Problems selected from the works of H. J. C. Andrews, E. N. Frankenstein, B. G. Laws, and C. Planck. Cassell & Company, Limited, London.

XUM

and instructive to composers. To this collection is added a treatise teaching how to make problems, and consequently how to achieve fame. In the words of the authors:—"Hitherto no chess work explanatory of the problem art has issued from the home press. . . . The essay contained in these pages, although emanating from the pen of Mr. Planck, has, after discussion and modification, received the assent of his colleagues, and may therefore be considered as representing the well-digested conclusions of four trained minds upon the most important questions relating to the chess problem in its modern form." We hope that no problemist will omit to obtain these "well-digested conclusions," for well-digested conclusions are in one respect similar to malted food (so ably explained by Mr. Mattieu Williams)—they are both easily assimilated. Appended are four examples taken from the book, from which it will be seen what a great amount of enjoyment may be derived from possessing these 400 brilliant chess problems:—

By H. J. C. Andrews.

Black.



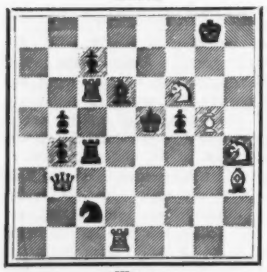
White.

Mate in three.

1. B to B8.

By E. W. Frankenstein.

Black.



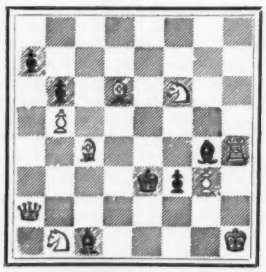
White.

Mate in two.

1. R to Q4.

By B. G. Laws.

Black.



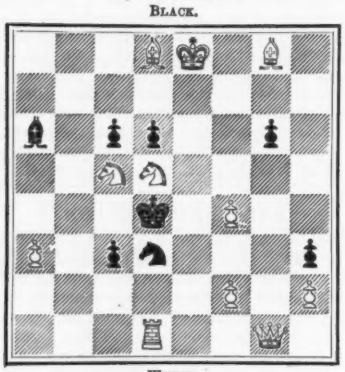
White.

Mate in two.

1. Q to R5.

By C. Planck.

Black.



White.

Mate in three.

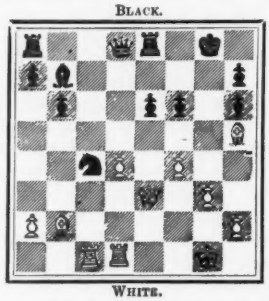
1. Q × P.

In connection with the above we have to make the melancholy announcement of the death of Mr. H. J. C. Andrews, which occurred recently. Mr. Andrews was an exceptionally-gifted problem composer, whose experience extended over forty years of work and gratuitous labour for the sake of chess. His death has called forth universal expressions of regret and esteem.

The following game was recently played in a Handicap Tournament at the British Chess Club:—

White. J. H. Zukertort.	Black. J. Gunsberg.
1. P to Q4	P to Q4
2. Kt to KB3	P to K3
3. P to K3	Kt to KB3
4. B to Q3	P to B4
5. P to QKt3	Kt to B3
6. B to Kt2	P × P
(An undesirable capture.)	
7. P × P	B to Q3
8. Castles	Castles
9. P to B4	P × P
10. P × P	P to QKt3
11. QKt to Q2	B to Kt2
12. R to Bsq	B to B5
(Early aggression. R to Bsq was good.)	
13. P to Kt3	Kt to QKt5
(Looks showy, but results in loss of time, as the Kt has to retreat presently.)	
14. B to K2	B to R3?
15. Q to R4!	Kt to R3?
(B × KKt, or Kt to B3 is better—leaves Black with a well-developed position.)	
16. KR to Qsq	Kt to Ktsq?
(Lamentable delusion.)	
17. Kt to K5	Kt to K5
(Missing another chance by B × Kt. 18. R × B, Kt to K5. 19. R to Qsq, Kt to Kt4, &c.)	
18. P to B4	P to B3
19. Kt to Kt4	Kt × Kt
20. R × Kt	Kt to Q2
21. Q to Kt3	Kt to B4
(Again results in loss of time.)	
22. Q to K3	Kt to K5
23. KR to Qsq	R to Ksq
24. B to B3	Kt to Q3
(White has got his Q and R better posted.)	
25. Kt × B (ch)	P × Kt
26. B to R5	Kt × P.

Black.

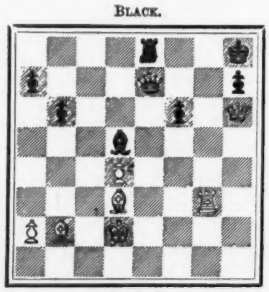


White.

(Making a virtue out of the necessity to escape from a bad position.)

White. J. H. Zukertort.	Black. J. Gunsberg.
27. R × Kt	Q to Q4
28. Q to K2	KR to QBsq
(Unfortunately for Black, White can check with his Q on Kt4, whereby he escapes the consequences of B to R3.)	
29. KR to QBsq	R × R
30. R × R	Q to R8 (ch)
31. K to B2	Q × P (ch)
32. K to Ksq	Q × P (ch)
33. Q to B2	Q to R6
34. B to K2	B to Q4
(Necessary to stop the uncovering of the B by P to Q5.)	
35. R to B7	K to Rsq
36. K to Q2	R to KKtsq
37. R to B3	Q to B4
(The choice lay between this move and Q to R8.)	
38. R to KKt3	R to QBsq
39. B to Q3	Q to R4
40. P to B5!	P × P
41. B × P	R to KBsq
42. B to Q3	Q to B2?
43. Q to B4	R to Ksq
44. Q × RP	Q to K2

Black.



White.

45. R to K3	Q × R (ch)
46. Q × Q	R × Q
47. K × R	B × P
(The game is lost, but it was wrong to take this P as the B thereby gets quite out of play.)	
48. B to K4	K to Ktsq
49. P to Q5	P to B4
(Unnecessary.)	
50. B to B3	K to B2
51. K to B4	K to K2
52. K × P	P to R4
53. K to K5	P to Kt4
54. P to Q6 (ch)	K to Qsq
55. B to Q4, and White won.	

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Our Whist Column.

BY "FIVE OF CLUBS."

MATHEWS ON WHIST.

(*Continued from p.* 120.)

LEADING TRUMPS.

[IT remains that the question of leading trumps should be considered.]

It is difficult to judge when to lead trumps. The following situations will assist the beginner to reason, and in general direct him properly [though they do not include all the cases in which it is generally proper to lead trumps]:—

1. With six trumps, on the supposition that your partner has a strong suit.
2. If you are strong in other suits, though weak in trumps.
3. If your adversaries open weak suits.
4. If your adversaries have scored three,* and you have no honour, or probability of making a trump by a ruff.

[In the fourth case, the lead of trumps is good for the reason that, unless your partner is strong in them, the game is probably lost, and if he is strong in them, you do well to lead them to him.]

[Mathews says specially that unless you have six trumps you should not lead trumps, unless either you or your partner have a strong suit. Modern play recognise five trumps, with or without strength in your own hand, as usually affording sufficient reason for a trump lead—except when you are playing for the odd trick, when it is generally well to wait before leading trumps, to see whether the required tricks may not be more safely secured by a ruffing game.]

In playing for an odd trick, you play a closer game than at other scores. You lead from single cards [modern Whist rejects this], and force your partner, when at other times such a course would not be justified [that is, even when you have reason to think he has length in trumps]. Hence it is seldom proper in this case to lead trumps.

[I must, however, take this occasion to note that the rule often laid down that you should refrain from leading trumps when you require but the odd trick would not be regarded as always to be followed. The very circumstance that by leading trumps the chance of securing the odd trick through a ruff or two may often be lost, shows that by leading trumps you may often deprive the enemy of the chance of making the odd trick by ruffing; and if you prevent the enemy from making the odd trick you commonly secure it for yourself and partner.]

Do not lead trumps merely because an honour is turned up on your left, nor be deterred from leading trumps because an honour is turned on your right hand. Either lead is proper if the circumstances of your hand require a trump lead; but neither otherwise. [Mathews's dictum is a little too positive. There can be nothing much more absurd than the practices he deprecates—that is, leading or refraining from leading trumps because of an honour turned up to left or right; yet the fact that an honour certainly lies on your left may make a trump lead, otherwise inexpedient, permissible, while an honour certainly on your right may make an otherwise expedient trump lead undesirable. The known position of an honour must be taken into account, and dealt with for what it may be worth.] There is a certain advantage in leading through an honour, as Mathews himself shows, by noting that "it is as advantageous to lead up to as through an Ace; not so advantageous to lead up to a King as up to an Ace; and disadvantageous to lead up to a Queen."] [Note, also, that the trump card may cause a deviation from the general rules for leading. Thus, if the trump leader holds Ace, King, ten, nine, with or without others, and the Queen or Knave was turned on his left, he would do well to lead the lowest of the ten, nine, sequence. If the honour is put on, he has at the next round a finesse against but one card. On the other hand, such a lead would be absurd if the Queen or Knave had been turned on the right.]

If you have the trump Ace, and the circumstances of your hand require two certain leads in trumps, lead the Ace, let the other trumps be what they may. [Be careful about the circumstances, however.] [*Per contra*, if the adversaries lead trumps, and you hold Ace and one or two others, put on the Ace at once; but] with the Ace and three other trumps, it is seldom right to win the first or second trick, unless your partner ruffs some other [when you put on your Ace to give him a ruff].

If you have Ace, King, and two more trumps, and your partner leads them originally, insure three rounds in trumps; but if he lead (in consequence of your showing your strength) a nine or any equivocal card, pass it the first time; by this you have the lead after three rounds of trumps—a most material advantage.

When with a very strong suit you lead trumps, hoping your partner may command them, show your suit first. But if you have strength in trumps in your hand, lead trumps first. With only four trumps, do not lead one unless your strong suit is established. With tierce major and another trump, however, and a sequence of three or more to the King, it is well to lead trumps twice, and then the Knave [or lowest of the head sequence] of your suit, continuing till the Ace is out. [It is only advisable, however, to lead the lowest of the head sequence in the plain suit, when you hold five cards or more in it.]

PLAY SECOND HAND.

There are points where good players disagree. Some play what is called a forward, others a more timid game. Some commonly put on a king second, others but rarely. In these cases a man may play either way without committing error, but where all good players are of the same opinion it should be received as an axiom. No good player puts on a Queen, Knave, or ten second; of course, this should be on all occasions carefully avoided. [It seems clear that though Mathews includes the case of the Queen, Knave, or ten with but one small one, he is here speaking generally, as in dealing with the play of King second hand. It would appear that in his day for play second hand the old-fashioned rule, "King ever, Queen never," was held as a general rule, where it was held at all. Nowadays, except where a smaller honour is led, no one thinks of putting on King, Queen, or Knave second hand, if holding two or more small cards. Nor does any recognised whist authority now sanction the play of King, Queen, or Knave second hand when there is but one small card—except when a lead is specially wanted.] On this point Mathews deals specially elsewhere, saying, with King and one more good players sometimes put on King second, sometimes not. If it is the trump card it should invariably be put on [this is no longer held], and generally it is good to play King, from King one other, in trumps. [This held till Clay's time, but is now discountenanced.] Queen or Knave should never be played [from Queen or Knave, one other], except in trumps, when a superior honour has been turned up on the right. It is interesting to notice thus how early the rule now accepted by all good players was recognised by skilful whist strategists as sound.

With Ace, Queen, ten of your right-hand adversary's lead, put on the ten. [The modern rule is, the ten in trumps, the Queen in plain suits.] With Ace, Queen, and others, not including the ten, put on a small one, unless he leads the Knave, in which case put on the Ace invariably. No good player with King, Knave, and ten will begin with the Knave; so that of course it is finessing against yourself to put on the Queen, as the King is certainly behind you. If fourth player holds it you give away at least the lead, and in any case can secure no possible advantage.

With King, Queen, &c., of your right-hand adversary's lead, put on one of them [the Queen unless you wish to deceive all round]; with Queen, Knave, and another, the Knave; with two or more small ones, the lowest. [Modern play enjoins the ten from Knave, ten, and another: some add the nine from ten and another; but that is running it rather close; the chance of helping fourth player is not equal to the chance of mischievously misleading him.]

With only three of a suit, put an honour on an honour, with four play your lowest. But the Ace should always be put on the Knave. [In Bohn's edition of Mathews, he is made to say "except the Ace should not be put on the Knave;" but the context, and what he says elsewhere, agree in showing that he said, or intended to say, here, the Ace should be put on the Knave second hand, even if you hold four in the suit.

If your right-hand adversary has led, and, his partner putting on Knave or Queen, your partner wins with the King—should a [small] card of that suit be again led on your right, if you have the ten put it on. It is probable that by doing this you keep the commanding card in your partner's hand, and prevent the second best from making.

NOTE ON THE CALL FOR TRUMPS.

In the good old days of Hoyle and Mathews unnecessarily high cards were not unfrequently played. But they were not played to inform partner. The old players would probably have included any practice of the sort among the offences contemptuously classed in their time as "Piping at Whisk." What Hoyle or Mathews would have said by the way, of the not uncommon extension of the signalling system where a partner hesitates before playing a small card to his partner's Ace or King lead, with the idea of either forcing his attention to the signal, or of showing (as the case may be) that though very strong, he is not *quite* strong enough to signal,

* Mathews, who deals with long whist, says here, of course, "if your adversaries are at the point of *eight*," but the same rule would guide in short whist, when they have scored three.

we can hardly say. Probably, like our "Pembridge"* to-day, they would have found ordinary words too weak to express their contempt and abhorrence of all such practices. But, as I have said, in their day unnecessarily high cards were played—*always*, however, as false cards to delude the enemy. An opponent is making his high cards in a suit of which a player holds, say, ten and three: if the ten is played, the opponent naturally expects to see the suit ruffed next round or early; and as naturally, he will discontinue the strong suit (unless the strategy of his game makes it desirable that he should play for a force), and probably lead trumps. The partner of the player, who has thus dropped an unnecessarily high card, will infer that the trump lead is wanted; and if the enemy fail to be deceived by the false card, he will lead trumps himself. In that sense, but in that sense only, the unnecessarily high card in Hoyle's time was, as it were, a call for trumps.

All this belongs to the delightful strategy of whist. There were in such cases several interpretations of the observed play to the particular trick, several inferences suggested by the previous fall of the cards. Neither the enemy nor the partner of the player who had dropped the high card, having a smaller one, could feel quite sure what the play might mean. That pleasing mixture of doubt and confidence—doubt because of the enemy's craft, confidence in the just discrimination skill affords between the probabilities for and against various interpretations—which constitutes the charm of real whist comes in—or, alas! that I should have to change the tense, came in, of yore—to give interest to such a stroke, and to the measures taken either to meet or foil it!

In the whist of to-day, which is calmly described by the professors of the signalling system as scientific whist, as if the whist of Hoyle and Mathews (far more soundly scientific in reality) were child's play, the unnecessarily high card does not involve any whist interest whatever. It means one thing, and one thing only. It is a command to partner to lead trumps.

THE FACE OF THE SKY FOR MAY.

THE sun is now so free from spots for days and even weeks at a time as to render a daily watch for them almost a waste of time. There is no real night in any part of Great Britain after the 22nd, twilight persisting from sunset to sunrise. The aspect of the night sky will be found depicted in map v. of "The Stars in their Seasons." No minima of Algol will, practically, be visible throughout the month. The best chance for the observer to detect Mercury will be before sunrise at the beginning of May. Venus is an evening star, shining most brilliantly at dusk over the W. by N. and W.N.W. parts of the horizon. At the end of the month she does not set until between eleven and twelve o'clock at night. She is gibbous in the telescope. She will be 2° 15′ north of Saturn at 5 P.M. on the 30th. Mars is totally invisible. Jupiter is above the horizon all night long, but, having south declination, should be observed as near to his time of meridian transit as possible. He is travelling through Virgo towards Spica. ("The Stars in their Seasons," map v.) The observable phenomena of his satellites occurring at convenient hours are tolerably numerous. On the 3rd, Satellite III. will begin its transit at 9h. 30m., followed by its shadow an hour later. The satellite will leave the planet's opposite limb at 11h. 5m. P.M., and its shadow twenty-nine minutes after midnight. On the 5th, Satellite II. will be occulted at 9h. 55m. P.M. On the 6th, the transit of Satellite I. will begin at 10h. 25m. P.M., and that of its shadow at 10h. 47m. At 12h. 37m. the satellite will pass off Jupiter's face, as will the shadow it casts at 12h. 59m. On the 7th, Satellite I. will reappear from eclipse at 10h. 13m. 14s. P.M. On the 10th, Satellite III. will enter on to the planet's limb at forty-seven minutes after midnight. On the 12th, Satellite II. will be occulted at 12h. 12m. P.M. On the 13th, Satellite I. will begin its transit ten minutes after midnight, as will its shadow thirty-one minutes later. On the 14th, Satellite I. will be occulted at 9h. 25m. P.M. One minute later Satellite II. will pass off Jupiter's disc, its shadow following at 10h. 34m. Satellite I. will reappear from eclipse at 12h. 7m. 16s. P.M. On the 15th, the egress of the same satellite from Jupiter's limb will happen at 8h. 48m. P.M., its shadow following at 9h. 22m. On the 21st the ingress of Satellite II. in transit occurs at 9h. 9m. P.M.; then Satellite III. will reappear from eclipse at 10h. 28m. 55s. At 10h. 33m. the shadow of Satellite II. will follow it on to Jupiter's limb; at 11h. 10m. Satellite I. will be occulted; and at 11h. 42m. Satellite II. will have left the face of the planet. On the 22nd the ingress of the shadow of Satellite I. happens at 9h. 5m. P.M., and the egress from the opposite limb of the satellite casting it at 10h. 35m. The shadow does not quit Jupiter's face until 11h. 17m. On the 28th Satellite III. will be occulted, disappearing at 9h. 21m. P.M., and not reappearing until 11h. 14m. Then Satellite II. begins its transit at 11h. 26m.; Satellite III. disappears in eclipse at 12h. 44m. 44s., and Satellite I. is occulted at 12h. 57m. On the 29th Satellite I. began its transit at 10h. 10m. P.M., followed by its shadow at 11h. The satellite leaves Jupiter's opposite limb at 12h. 22m.; the shadow not until the next morning. Lastly, on the night of the 30th, Satellite II. will reappear from eclipse at 10h. 17m. 19s; as will Satellite I. at 10h. 24m. 12s. Saturn is now approaching the west, and must be looked for the moment the sky is dark enough, even at the beginning of May. He is pretty close to δ Geminorum ("The Stars in their Seasons," map ii.). Uranus is about south at sunset, so like Saturn must be looked for as soon as ever the twilight deepens. He is S.W. of γ Virginis ("The Stars in their Seasons," map v.). The Moon is full at 2h. 13m. P.M. on the 7th, and enters her last quarter at 8h. 17·4m. P.M. on the 14th; she is new at 11h. 5·4m. on the 22nd; and enters her first quarter at 5h. 19·7m. A.M. on the 30th. Four occultations only of fixed stars occur at convenient hours during the May nights. They are as follows:—On the 4th γ¹ Virginis, a star of the 2¼th magnitude, will disappear at the Moon's dark limb at 25 minutes after midnight at an angle of 141° from her vertex. It will reappear the next morning at 1h. 8m. at her bright limb at a vertical angle of 230°. Then, on the 29th, 45 Leonis, a 6th magnitude star, will disappear at the dark limb at 8h. 37m. P.M., at an angle of 69° from the vertex of the Moon, its reappearance at her bright limb happening at 9h. 34m., at an angle of 314° from her vertex. Later, at 11h. 10m. P.M., ρ Leonis, a star of the 4th magnitude, will disappear at the dark limb at a vertical angle of 88°. It will reappear at her bright limb at 2 minutes after midnight, at an angle from her vertex of 311°. Lastly, on the 30th, σ Leonis, also of the 4th magnitude, will disappear at the dark limb at 7h. 46m. P.M., at an angle of 152° from the Moon's vertex, its reappearance at the bright limb occurring at 8h. 6m. at a vertical angle of 188°. When these notes begin, the Moon has just entered on the confines of Leo ("The Seasons Pictured," plate xxiv.), through the whole length of which constellation she is travelling until 10h. P.M. on the 3rd, at which hour she enters Virgo ("The Seasons Pictured," plate xxv.). Her passage across Virgo occupies her until 6h. 30m. P.M. on the 6th, and she then crosses into Libra ("The Seasons Pictured," plate xxvi.). Travelling over Libra, she arrives at noon on the 8th on the boundary of the narrow northern spike which runs up from Scorpio, and when, by 9h. o'clock the same evening she has crossed this, it is to emerge in Ophiuchus. At 11 A.M. on the 10th, she quits Ophiuchus for Sagittarius, which she leaves in turn for Capricornus at 8h. 30m. P.M. on the 12th ("The Seasons Pictured," plate xxi.) Her journey over Capricornus is completed by 4 A.M. on the 14th, when she enters Aquarius. She continues in Aquarius until 4h. A.M. on the 17th. She then crosses into Pisces ("The Seasons Pictured," plate xxii.). She remains in this great straggling constellation until 8h. A.M. on the 20th, and then arrives on the confines of the northerly prolongation of Cetus. By 10 o'clock the same night she has gone through this and come out in Aries ("The Seasons Pictured," plate xxiii.). She is in Aries up to 2h. 30m. A.M. on the 22nd, when she enters Taurus. Pursuing her path through Taurus, we find her at 9h. 30m. P.M. on the 24th on the boundary of the most northerly part of Orion. Twelve hours later she has crossed this and emerged in Gemini ("The Seasons Pictured," plate xxiv.). Her passage over Gemini terminates at 3h. A.M. on the 27th, when she leaves it for Cancer. She quits Cancer in turn for Leo, at 4h. P.M. on the 28th. She is in Leo up to 5 A.M. on the 31st, and she then crosses the boundary into Virgo. She is still in Virgo at midnight on the 31st.

* It was Pembridge who brought into use, if he did not actually invent, the pleasing word "Bumblepuppy," as the name for that kind of whist which the constant follower of conventions is in the habit of playing; as Bumbledom has found a place in dictionaries written since "Oliver Twist" appeared, I conceive that Bumblepuppy ought soon to be similarly authenticated.

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